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Freire Duenas, Wilfrido T.; Winkleman de la Cruz, German
Massachusetts Institute of Technology

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THE EFFECT OF INITIAL DEFLECTION
ON THE STRESS DISTRIBUTION IN A
PANEL OF PLATING OF A SHIP UNDER
TENSILE LOAD

Wilfrido T. Freire Duenas
and
German Winkelmann De La Cruz

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ON THE STRESS DISTRIBUTION IN A PANEL
OF PLATING OF A SHIP UNDER TENSILE LOAD

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THE EFFECT OF INITIAL DEFLECTION
ON THE STRESS DISTRIBUTION IN A
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WILFRIDO T. FREIRE DUENAS
and
GERMAN WINKELMANN DE LA CRUZ

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ABSTRACT

THE EFFECT OF INITIAL DEFLECTION ON THE STRESS DISTRIBUTION IN A PANEL OF PLATING OF A SHIP UNDER TENSILE LOAD

by

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Submitted to the Department of Naval Architecture and Marine Engineering on May 24, 1954, in partial fulfillment of the requirements for the degree of Naval Engineer

OBJECT

The object of this investigation was to obtain quantitative data of the stress distribution in a panel of plating representing the plating of a vessel under tensile load, in order to establish a relation between the ratio of maximum stress to average stress and the ratio of initial deflection to plate thickness.

It is expected that a complete investigation of the effect of initial deflection on the stress distribution in a panel of plating will provide a technical criteria to specify the maximum allowable initial deflection to avoid excessive stress in the material.

METHOD

Four specimens were made of 1/8" plate with welded stiffeners forming 3 panels of 18" x 6". The models were designed to be bolted to pulling members adapted to fit a 300,000 pound tensile testing machine. Roughly the initial deflection of the center panel of the models were: zero, 1/8", 3/16" and 1/4".

The samples were tested using the stress-coat technique to determine the direction of the principal stresses.

SR-4 strain gages type A-3 were installed in two rows, one at the center of the panel and the other near the transverse stiffener, at both sides of the plate.

The samples were tested by applying the load gradually, and the strains recorded at each interval of load.

Plots were made of the load versus strain for each strain

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INTRODUCTION

THE PURPOSE OF THIS INVESTIGATION IS TO DETERMINE
IF A RELATIONSHIP EXISTS BETWEEN THE

AND

STUDIES BY J. H. KELLEY
CONCERNING THE EFFECTS OF VIBRATION ON THE

STRESS RESPONSE OF THE HUMAN
SYSTEM TO VIBRATION

ADDITIONAL TO THE INFORMATION ON THE EFFECTS OF VIBRATION ON THE
STRESS RESPONSE OF THE HUMAN SYSTEM, THE EFFECTS OF VIBRATION ON THE
STRESS RESPONSE OF THE HUMAN SYSTEM WILL BE STUDIED.

OBJECTIVE

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SCOPE

THIS INVESTIGATION WILL BE LIMITED TO THE STUDY OF THE EFFECTS OF
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gage. From these diagrams strains were obtained at loads of 20, 40, 60, 80 and 100 kips, and these values were plotted against the position of the strain gage on the plate. The mid-depth strain distribution was obtained by averaging the strains at each point on both sides of the plate.

From the strain distribution diagrams the maximum and minimum strain values were obtained, as well as the average strain in the plate, at each level of load. The ratio of maximum and minimum strain to average strain in the plate were thus obtained, and these values plotted against the ratio of initial deflection to plate thickness.

The strain distributions at 60 kips load were used to check the data, by comparing the integration of stress times cross sectional area with the corresponding load.

RESULTS AND CONCLUSIONS

It was observed that when deflection exists the strain is not uniformly distributed. The maximum strains were found on the unstiffened face of the panel at about the quarter points. The minimum strains were found on the stiffened face, which is the convex face of the panel, at about the center of the panel. The mid-depth maximum strains were found close to the stiffeners.

The ratio maximum to average strain increases almost linearly, within the elastic region of the material, with the increase of the ratio initial deflection to plate thickness; the reverse is the case of the ratio minimum to average strain. All of these ratios approach to unity with the increase of load.

It should be noted that the maximum stresses were observed on the concave face, and that on the convex face the stress was so small that it became negative, or compressive stress, for initial deflection thickness ratio greater than one.

RECOMMENDATIONS

1. Construction and testing of samples of different aspect ratio.
2. Construction and testing of samples with low depth of stiffeners welded at both sides of the plate, in order to obtain the neutral axis of the stiffeners in line with the neutral axis of the plate to eliminate bending moment effects.

Thesis Supervisor: JOHN HARVEY EVANS
Associate Professor of Naval Architecture

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1991-1992

Cambridge, Massachusetts

May 24, 1954

Secretary of the Faculty
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

Dear Sir:

In accordance with the requirements for the degree of Naval Engineer, we submit herewith a thesis entitled, "The Effect of Initial Deflection on the Stress Distribution in a Panel of Plating of a Ship Under Tensile Load".

Respectfully yours,

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90	90	90	90
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92	92	92	92
93	93	93	93
94	94	94	94
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98	98	98	98
99	99	99	99
100	100	100	100

I. INTRODUCTION

In the structural design of a vessel the hull is considered to work as a beam. The difference between the buoyancy distribution and the weight distribution causes a longitudinal bending moment.

It is standard practice to design the strength of the hull, by considering the vessel in two extreme conditions: floating on a wave with the same length of the vessel and with the crest at each end of the vessel, called "sagging condition", and with the crest amidship, called hogging condition. These two conditions are considered to be the most severe manners of loading.

Tests have been made for many years to prove that the hull works as a beam. The first extensive experiments were carried out on the 200 feet transversely framed British destroyer "Wolf" in 1903, and while in many respects setting the pattern for subsequent work, they left many questions unanswered principally because of the scanty strain data taken below the vessel's neutral axis. In 1930 two identical 310 feet transversely framed U.S. destroyers, the "Preston" and the "Bruce", were observed while being loaded in sagging and hogging respectively. Within the past three years another British destroyer, the 355 feet longitudinally framed "Albuera" was similarly loaded in hogging. All these vessels were of riveted construction and were loaded by means of being supported on piers in drydock as the water level and the internal weight distribution was varied. The "Preston", "Bruce", and "Albuera" were loaded to destruction when complete buckling of deck or bottom structure occurred. Except on the "Wolf", for which fore and aft strains only

were measured, multi-axial plain strains were determined enabling principal stresses in magnitude and direction to be calculated. In all cases, stress distribution was found to be in generally good agreement with the classical beam theory, even for extended ranges of loading.

During the past World War II, the emergency merchant fleet was built almost entirely by welding type of construction. Some of these ships were reported damaged by cracking of the hull structure. Investigations of these failures arrived to the following causes of failure:

(a) Stress concentration due to notch effect, being the notch introduced by poor design (corner of hatches, non-continuity of longitudinal members), or caused by poor welding (low penetration, inclusions, blows in the melted metal).

(b) Brittle fracture at low temperature.

These causes explained the failure of vessels that cracked due to notch effects, or that failed because the material had a high critical temperature, but failed to explain why well designed vessels and well constructed suffer cracks in summer when a sister ship is still in service.

A theory advanced to the authors by Professor J. H. Evans, of the Massachusetts Institute of Technology relates the variation in stress to the amount of initial bulge in the panel between stiffeners. If an initial bulge exists in a section of ship plating of a transversely framed vessel, and this section is loaded in tension, the part of the plating containing the bulge will be unable to assume its apportioned share of the load until the deflection is removed; the

were removed, notwithstanding the fact that the removal was necessary in order to maintain the integrity of the record. It is noted that the removal was made in accordance with the provisions of the Act, and that the removal was made in accordance with the provisions of the Act.

It is further noted that the removal was made in accordance with the provisions of the Act, and that the removal was made in accordance with the provisions of the Act. It is further noted that the removal was made in accordance with the provisions of the Act, and that the removal was made in accordance with the provisions of the Act.

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section of the plating adjacent to the longitudinal stiffeners will therefore receive and maintain a disproportionately high part of the load. It is conceivable that the high stresses developed could cause surface crackings, and subsequent failure.

Several investigations have included observations which tend to substantiate the foregoing idea. The Admiralty Ship Welding Committee reported full scale tests on the British identical cargo ships "Ocean Vulcan" and "Clan Alpine", and on identical tankers "Neveritas" and "Newcomb"; one vessel in each pair was all riveted while the other was predominantly all welded. The findings of interest to this report are well summarized in Figure I. The stresses in way of the longitudinal stiffeners of the welded ships, for both hogging and sagging conditions, are much greater than the stresses clear of the stiffeners. This is not true for the case of riveted ships, and the difference could be laid to the minor accommodations in the riveted joints to suit the imposed loads.

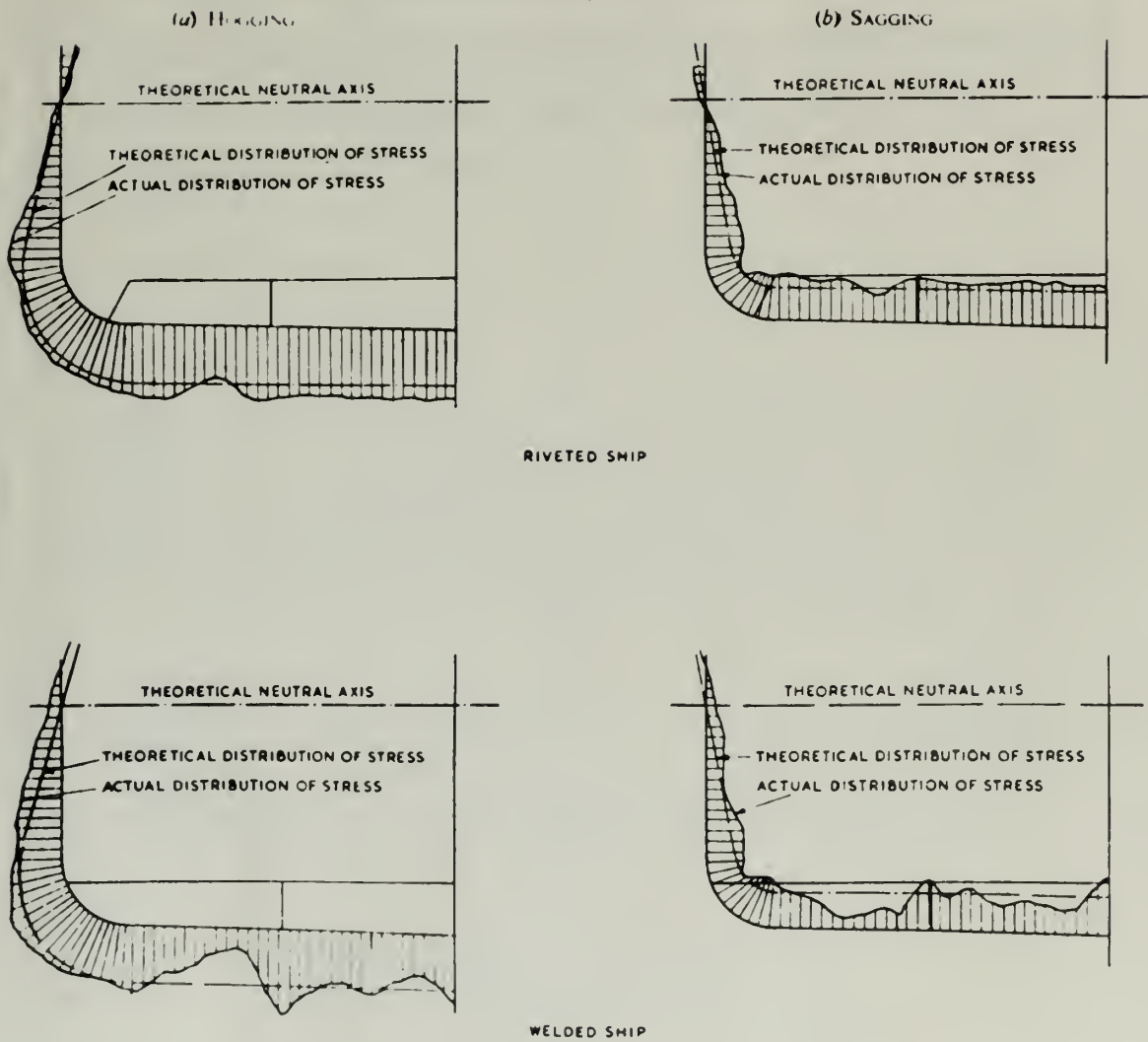
What the allowable limit of unloaded plating unfairness should be is a question which needs answering for the benefit of all and the limit which insures against crack formation at the panel supports under the maximum coplanar loading anticipated is the ultimate criterion to be used in coming to a decision.

However, it seems that an excessive unloaded deflection may be attained not only during construction, but by growth under the lateral water pressure or the ship hogging and sagging loadings. For such increasing permanent set to take place under ship service conditions apparently some initial unloaded panel unfairness is also necessary.

[illegible]

FIGURE I

Distribution of longitudinal stresses for bottom shell plating near amidships for merchant vessels.

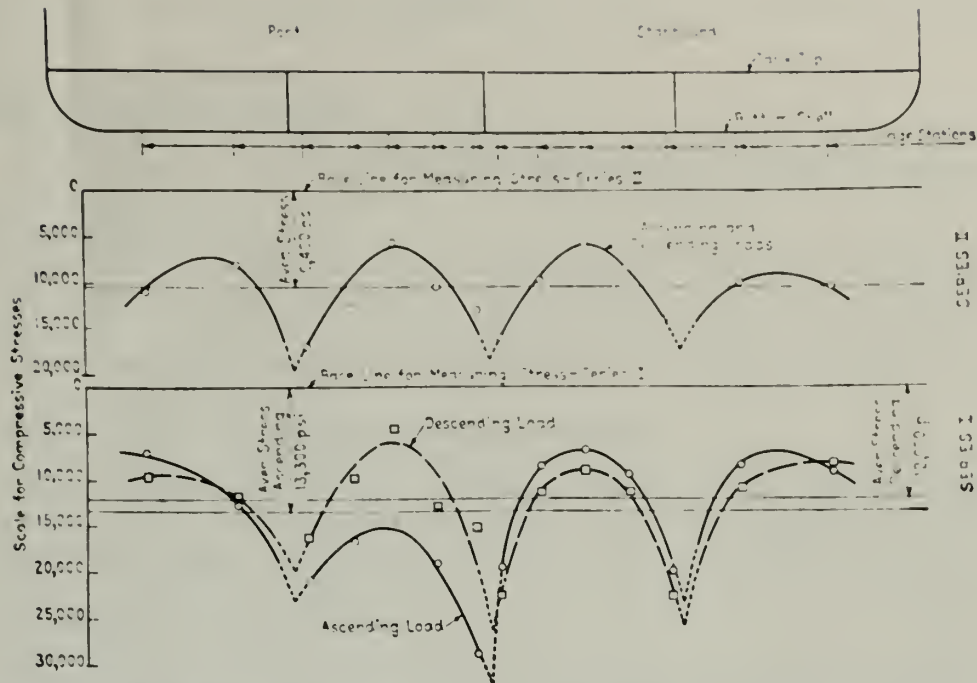


but its limiting value is presumably less than that which makes for sufficient peaking of stress in the fore and aft direction at the boundaries to cause the crack which may immediately or subsequently propagate under the proper conditions, probably including low temperature, or perhaps some transverse strain restraint offered by the framing. Figure II illustrate the case of increasing unfairness of the plating caused by the longitudinal bending moment, from observations made on experiment carried out on the "Philip Schuyler".

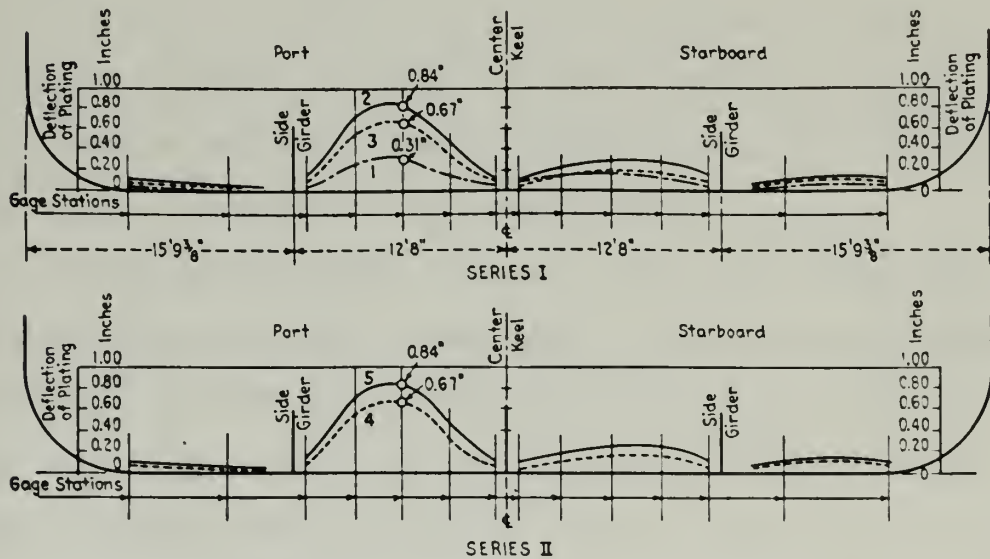
Unfairness under alterante tensile and compressive stress naturally compounds the evils.

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FIGURE II



Longitudinal Membrane Stresses for Hog Moment of 134,000 Foot-Tons



- 1 Initial position of bottom plating
- 2 Position under first hogging moment of 134,000 ft. tons (hog 1)
- 3 Position on return to 20,000 ft. tons (inter-hog 2)
- 4 Position under 20,000 ft. tons (inter-hog A & inter-hog B)
- 5 Position under second hogging moment of 134,000 ft. tons (hog A)

Deflection Profile of Bottom Plating
Midway Between Two Frames Amidships

Bottom Plating Behavior on the PHILIP SCHUYLER

II PROCEDURE

2.1 Design of the Test Section

The design of the test section was governed by the following practical considerations:

- a) The load capacity and size of the available testing machines.
- b) Cross sectional area of the test section to obtain proper stress values with the selected testing machine.
- c) Linear dimensions of the specimen to fulfill the selected cross sectional area, considering the proportion of dimensions used in ship building practice.
- d) Desirability of uniform stress distribution along the loading edges of the section to be tested.

With this considerations in mind the following was done. A testing machine of 300,000 pounds of rated load capacity was selected, which has a maximum destructive load of 225,000 pounds, one of the largest available machines in order to reduce scale effects.

In the transverse framing system used in naval architecture, the common aspect ratio is from 3 to 3.75; these values were obtained from the Rules of the American Bureau of Shipping. The aspect ratio 3 was selected, and a panel of 6" x 18", with a plate of 1/8" thickness was considered adequate. Stiffeners of 1/4" thickness plate, and of 2 1/2" depth were used, avoiding the use of profiles like "L" or "T" to facilitate the installation of the strain gages.

With the above dimensions we obtain a cross sectional area of the test section of 4.25 square inches, thus, the average stress with the

2.1. Design of the Test Machine

The design of the test machine was governed by the following

practical considerations:

- a) The load capacity and size of the available testing machine.
- b) Cross sectional area of the test section in order to obtain desired values with the selected testing machine.
- c) Linear dimensions of the specimen to utilize the smallest cross sectional area, consistent with the proportion of dimensions used in ship building practice.
- d) Feasibility of uniform stress distribution along the loading edges of the section to be tested.

With this consideration in mind the following was done: A

testing machine of 200,000 pounds at rated load capacity was selected, which has a maximum desirable load of 250,000 pounds, one of the largest available machines in order to remove some errors.

In the previous testing work used in steel construction,

the common aspect ratio is from 3 to 2.5; these ratios were obtained from the ratio of the length to width of the specimen. The aspect ratio 3 was selected, and a panel of 6' x 18", with a plate of 1/8" thickness was considered adequate. Dimensions of 1/4" thickness plate, and of 1/4" depth were used, providing the use of available 11/2" x 18" or 18" x 18" plates.

The installation of the stress gauges.

With these dimensions we obtain a cross sectional area of the

test section of 1.12 square inches, thus, the average stress with the

destructive loading capacity of the testing machine was 53,000 psi; this was considered satisfactory.

The test section with its dimensions is shown in figure III. It can be noted that three panels were used; the panel to be deflected was the central one, where the strain measurements were made, the other two panels being provided to obtain a more uniform stress distribution, and they were not deflected.

The neutral axis of the complete test section without initial deflection was calculated to be 0.449 inches from the unstiffened face of the plate. Considering that in way of the stiffeners the neutral axis shifts toward the mid-depth of the stiffeners, and that at the midway between stiffeners the neutral axis shifts toward the mid-thickness of the plate, there was a compromise to fulfill for the application of the load. The test sections were designed to be loaded in a plane through the mid-depth of the plate, and the scantlings of the stiffeners were decreased at the ends, as shown in figure III.

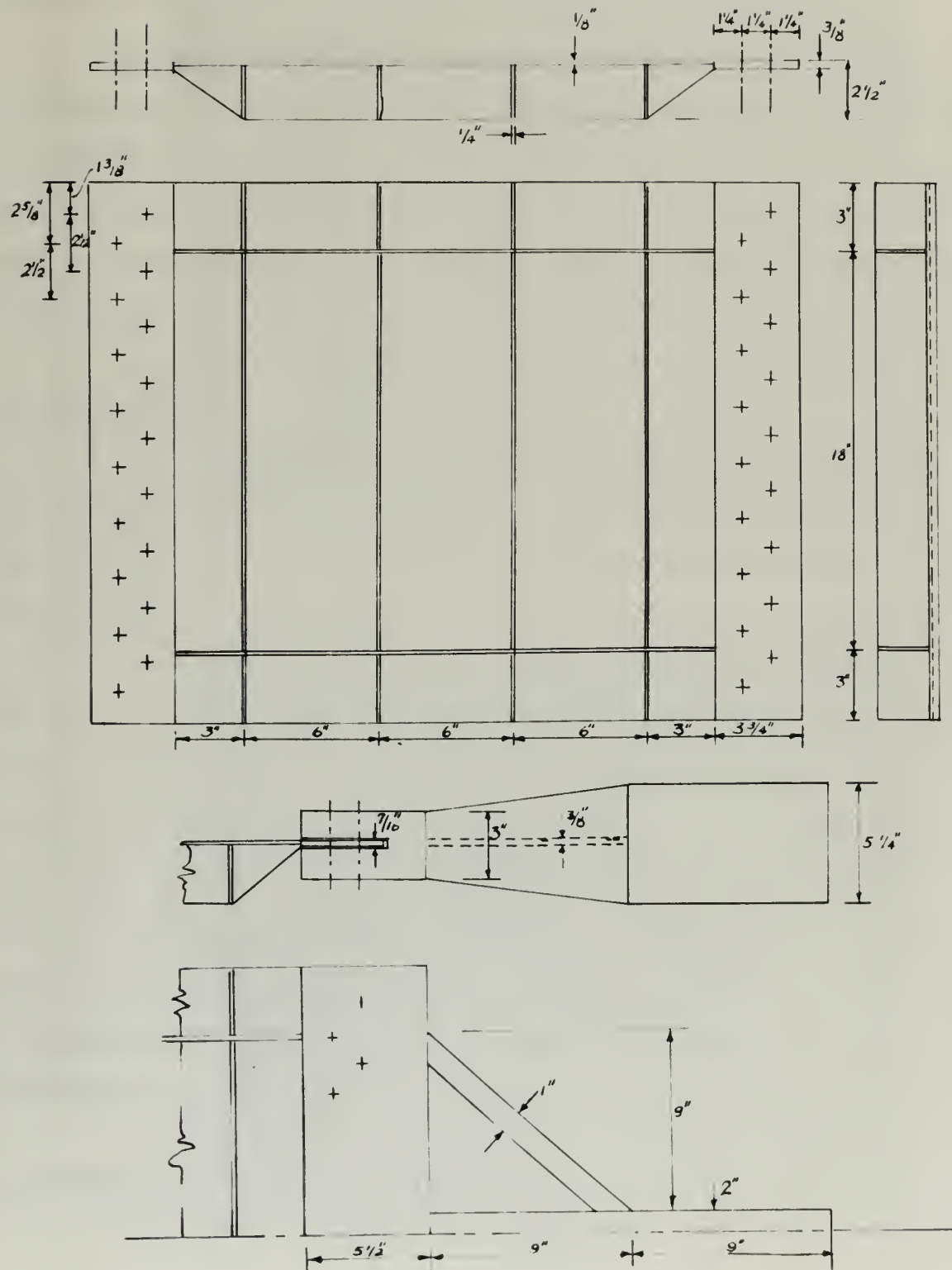
2.2 Design of the Pulling Members

The pulling members were designed to work under the yield point of the material at the maximum load capacity of the machine in order to minimize the deflection of the members and to obtain a fairly uniform stress distribution on the test section.

The linear dimensions obtained from the design calculations are shown in figure III. It may be estimated that the weight of each pulling member was about 250 pounds, and their cost much higher than that of the test section; therefore, it was considered desirable to have detachable

FIGURE III

TEST SECTION AND PULLING MEMBER



pulling members instead of having them welded to the test sections, in order to facilitate the handling of the equipment and to reduce the initial cost.

The test section was attached to the pulling members by means of 18 bolts of $1/2$ " diameter, and the strength of this joint considered as a riveted joint was greater than the strength of the test section; it should be noted that the thickness of the plate is increased at the bolted joint in order to obtain greater strength at the joint than at the test section.

2.3 Fabrication

The test sections and pulling members were made at "Saul Avery Steel Company", Cambridge, Massachusetts. The material used was commercial mild steel. The process of fabrication was arc welding. A heat treatment for stress relief was used at the end of the fabrication.

The test sections with zero nominal deflection and with $1/8$ " nominal deflection received the initial deflection in the central panel during the fabrication by effect of the welding of the stiffeners. The test section with $3/16$ " nominal deflection was hammered to increase the bulge caused by welding to the desired amount of deformation. The test section with $1/4$ " nominal deflection received the deflection of the central panel by lateral pressure using a compression testing machine of the Laboratory of Testing Materials at the Massachusetts Institute of Technology, with the aid of a piece of wood to avoid indentations.

2.4 Measurement of the Initial Deflections

The initial deflection was measured with a dial gage graduated in

pulling members instead of being then added to the test section, in order to facilitate the handling of the equipment and to reduce the initial cost.

The test section was attached to the pulling device by means of 12 bolts of 1 1/2" diameter, and the strength of this joint was increased as a riveted joint was greater than the strength of the test section. It should be noted that the thickness of the plate is increased at the bolted joint in order to obtain greater strength at the joint than at the test section.

2.3 Fabrication

The test section and pulling members were made of "A36" steel. Steel Company, Cambridge, Massachusetts. The material used was commercial mild steel. The process of fabrication was the welding. A heat treatment for stress relief was used at the end of the fabrication. The test sections with zero residual deflection and with 1/8" residual deflection received the initial deflection in the central panel during the fabrication by effect of the welding of the stiffeners. The test section with 3/16" residual deflection was prepared by increasing the bulge caused by welding to the desired amount of deformation. The test section with 1/4" residual deflection received the deflection of the central panel by lateral pressure using a compression casting section of the Laboratory of Testing Materials of the Massachusetts Institute of Technology, with the aid of a block of steel in which deflection

2.4 Measurement of the Initial Deflection

The initial deflection was measured with a dial gage graduated in

thousandths of an inch, mounted in a metal frame as shown in Figure IV. The frame was mounted in such a way that zero readings were obtained at 3 corners of the panel.

Measurements were made at intervals of $1/2$ inch along parallel lines spaced $1/2$ inch apart. Observed deflections are recorded in Table I in Appendix A.

The initial deflection data was plotted on cross-section paper, and contours of constant deflection were drawn, as shown in the "Contour Map of Initial Deflection", Figures V, VI, VII, and VIII.

To obtain the initial deflection of each test section, the following procedure was used:

- a) The arithmetical mean averages of readings taken along the long borders of the panel, within the central 10 inches, were first computed.
- b) Next, the arithmetical mean average of readings taken along the transverse centerline of the panel were computed, within the central 10 inches, which is the section that showed the maximum deflection.
- c) Finally, the difference between half the sum of the border arithmetical mean values and the center line arithmetical mean value gave the resultant average deflection of the panel. This calculation is shown on Table V in the Appendix C.

2.5 Stress-Coat Tests

The surfaces of the center panel of each test section were cleaned and polished with emery cloth. Next the surfaces were sprayed with precoat

transmission of the virus, which is a highly contagious disease. The virus was isolated from the blood of the patient and was found to be identical with the virus isolated from the patient.

The following table shows the results of the tests performed on the blood of the patient and the blood of the patient's family members. The results are given in Table I. The results show that the virus was present in the blood of the patient and his family members, but not in the blood of the patient's friends. This indicates that the virus was transmitted from the patient to his family members.

To obtain the initial isolation of the virus, the following procedure was used:

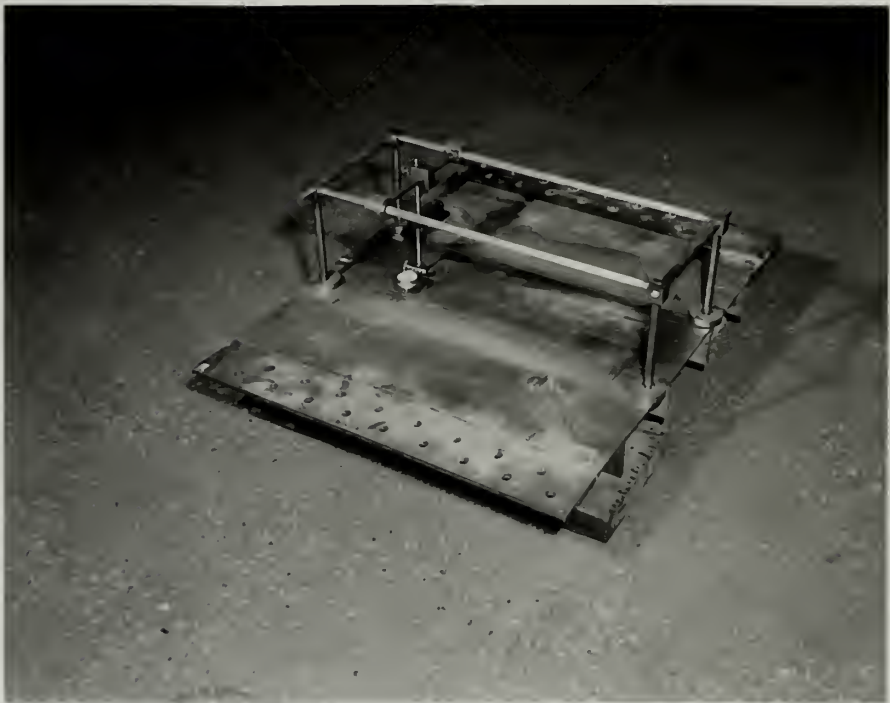
- a) The initial virus average of the patient's blood was found to be 100 units of virus per ml. of blood. This was the first isolation of the virus.
- b) The initial virus average of the patient's blood was found to be 100 units of virus per ml. of blood. This was the first isolation of the virus.
- c) The initial virus average of the patient's blood was found to be 100 units of virus per ml. of blood. This was the first isolation of the virus.
- d) The initial virus average of the patient's blood was found to be 100 units of virus per ml. of blood. This was the first isolation of the virus.
- e) The initial virus average of the patient's blood was found to be 100 units of virus per ml. of blood. This was the first isolation of the virus.

The results of the tests performed on the blood of the patient and his family members are given in Table I. The results show that the virus was present in the blood of the patient and his family members, but not in the blood of the patient's friends. This indicates that the virus was transmitted from the patient to his family members.

FIGURE IV



Specimen



Measurement Device of Initial
Deflection

in order to obtain a smooth surface. Then the stress-coat was applied. The precoat and the Strain Indicating Coating SI-1208 were manufactured by "Magnaflux Corporation", Chicago 31, Illinois.

The type of stress-coat selected was determined by the weather conditions, since temperature and humidity changes may cause cracking of the stress coat. The drying period of the stress-coat was 24 hours. In every test the weather condition did not change from the time of application of the stress coat to the time at which the test was performed.

The specimens were loaded to 80,000 pounds in order to obtain a complete crack pattern of the stress-coat. The crack pattern appeared only on the unstiffened side of the panel: no cracks were observed on the other side.

An attempt to make the crack pattern stand out by using dye-etching failed because the stress-coat was dissolved by the dye and the pattern disappeared.

In order to obtain a record of the crack pattern, it was necessary to mark the cracks with ink or pencil on the stress-coat itself. The next step was to transfer the delineated pattern to transparent paper. The "Pattern of Cracks in Stress Coat", are shown in Figures IX, X, XI, and XII.

The strain gages were aligned with the direction of the principal stresses, which is perpendicular to the direction of the cracks. It was considered that the strain gages on the stiffened side of the plate, where no crack pattern was formed, should be oriented in the same direction as the strain gages on the unstiffened side of the plate, because the direction

in order to obtain a smooth surface. The two specimens were polished.
 The specimen and the other following (specimen 17-150) were mounted
 by "Kodak Corporation", Chicago, Ill., Illinois.
 The type of stress-strain behavior was determined by the method
 described, since temperature and density changes were observed
 of the stress field. The sign of the stress field was determined
 in every test the specimen was held at the same time of
 application of the stress field to the time it was the test was completed.
 The specimen was loaded to 10,000 pounds in order to obtain
 a complete stress pattern of the stress field. The stress pattern appeared
 only on the horizontal side of the beam; no stress was observed on
 the other side.

An attempt to make the stress pattern stand out by using dye-
 etching failed because the stress field was dissolved by the dye and the
 pattern disappeared.

In order to obtain a record of the stress pattern, it was necessary
 to make the exact with the in pencil on the stress-strain field. The next
 step was to transfer the obtained pattern to transparent paper. The
 "Pattern of Stress in Stress Field", was shown in Figure II, I, II, and

III.

The stress pattern was obtained after the direction of the principal
 stresses, which is perpendicular to the direction of the stress. It was
 considered that the stress pattern on the vertical side of the plate, where
 no stress pattern was found, should be included in the same direction as
 the stress pattern on the horizontal side of the plate, because the direction

of the principal stresses would not change through the small thickness of the plate.

It should be noted that the cracks of the stress-coat were not produced at low level of load, but that they started to appear for loads above 60,000 pounds. Therefore, the orientation of the strain gages was governed by the direction of the principal stresses at high loads. It is believed that the direction of the principal stresses changed with the load. Because the magnitude of the deflection probably changed with the load; therefore, the measured strains at loads other than that which caused the cracks are not the true values of the principal strains.

Nevertheless, the strains measured by the strain gages located in the transverse centerline of the panel are undoubtedly principal strains; since by symmetry, the principal strains should be oriented in the direction of the applied load, and the fact that the observed cracks are perpendicular to the transverse centerline on all specimens supports this conclusion. This consideration is emphasized to validate the conclusions of the experiment.

2.6 Application of Strain Gages

SR-4 Strain Gages type A-3 manufactured by "The Baldwin Lime-Hamilton Corporation", Philadelphia 42, Pennsylvania, were used. They were applied using SR-4 Pre-Coat and Cement, following the manufacturer's instructions using 64 Strain Gages per test section.

The locations considered ideal for the strain gages to obtain the curve of strain distribution is shown in Figures IX and through XII, but due to some small irregularities in the surface of the plate some of the

of the principal stresses would not change through the small thickness
of the plate.

It should be noted that the amount of the stress-peak was not
proportional to the level of load, but that they started to appear at loads
above 50,000 pounds. Therefore, the orientation of the strain gages was
governed by the direction of the principal stresses at high loads. It
is believed that the direction of the principal stresses changed with
the load. Because the magnitude of the deflection rapidly changed with
the load; therefore, the maximum strain at loads other than that which
caused the cracks are not the same as that of the principal stresses.
Nevertheless, the strains measured by the strain gages located
in the transverse centerline of the panel are undoubtedly principal strains
since by symmetry, the principal stresses should be oriented in the
direction of the applied loads, and the fact that the observed strains are
perpendicular to the transverse centerline on all specimens supports
this conclusion. This conclusion is supported so well by the
conclusion of the experiment.

2.2 Simulation of Strain Gages

2A-4 Strain gages (type 4-7) manufactured by The Baldwin Line-
Rustless Corporation, Philadelphia, PA, Pennsylvania, were used. They
were applied using 2A-4 Pre-Coat and Cement, following the manufacturer's
instructions using 2A Strain Gages for test method.
The locations considered ideal for the strain gages to obtain
the curve of strain distribution is shown in Figure 12 and through 13, and
also in some small illustrations in the surface of the plate some of the

strain gages where applied in a slightly different location as indicated by Table II in the Appendix A. "Front Face" indicates the unstiffened side of the plate, and "Back Face" the stiffened one.

After the strain gages were applied and the cement had dried for 24 hours, the gages were electrically tested for continuity and insulation from the plate; the minimum insulation measured was 25 megohms, which is far above the required insulation of 5 megohms. Figure XIII is an illustration of a test specimen with the strain gages in place.

2.7 Strain Measurement

The testing machine used to load the specimens in tension was a "Southwark-Emery" hydraulic type, MIT serial 105. The control panel of this machine and the set-up of the equipment is shown in Figure XIV.

The strain gages were connected between ground and a switch-board formed by knife switches. Through the switch-board, the strain gages were connected to an SR-4 Strain Indicator, type L, serial H30797, manufactured by Baldwin-Southwark.

An initial load of 20,000 pounds was used to line-up the specimen in the testing machine, and then the load was reduced to zero to obtain the strain reading at zero load. Next the load was applied gradually, and the strains recorded at each level of load, as indicated in Table III in the Appendix A.

It should be noted that during the application of the load to measure the strains, some slip of the pulling members at the jaws of the testing machine was noticed, and this fact somewhat invalidated the

strain gauges were applied in a standard differential technique as indicated by Table II in the Appendix A. "Tensile Load" indicates the vertical side of the plate, and "Shear Load" the horizontal side. After the strain gauges were applied and the cement had dried for 24 hours, the gauges were electrically tested for continuity and insulation from the plate; the strain gauges were connected to a Wheatstone bridge, which is the above the typical illustration of a Wheatstone bridge. Figure III is an illustration of a test specimen with the strain gauges in place.

2.7. Tensile Test Results

The testing machine used to load the specimens in tension was a "Sanborn-Berry" hydraulic type, with serial 102. The control panel of this machine and the set-up of the specimen is shown in Figure IV. The strain gauges were connected between ground and a voltage divider formed by three resistors. Through the voltage divider, the strain gauges were connected to an RS-A strain indicator, type 1, serial 22077, manufactured by Baldwin-Schwartz.

An initial load of 20,000 pounds was used to line-up the specimen in the testing machine, and then the load was reduced to zero to obtain the strain reading of zero load. Next the load was applied gradually, and the strain recorded at each level of load, as indicated in Table III in the Appendix A.

It should be noted that during the application of the load to measure the strain, one tip of the pulling members at the base of the testing machine was notched, and this fact somewhat facilitated the

FIGURE XIII



Specimen with Strain Gages

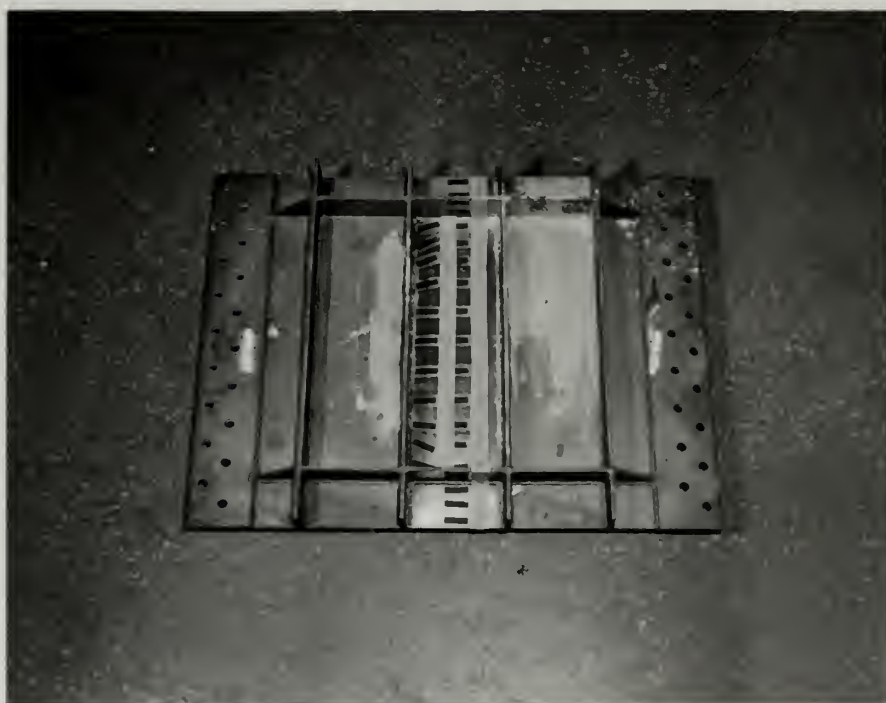
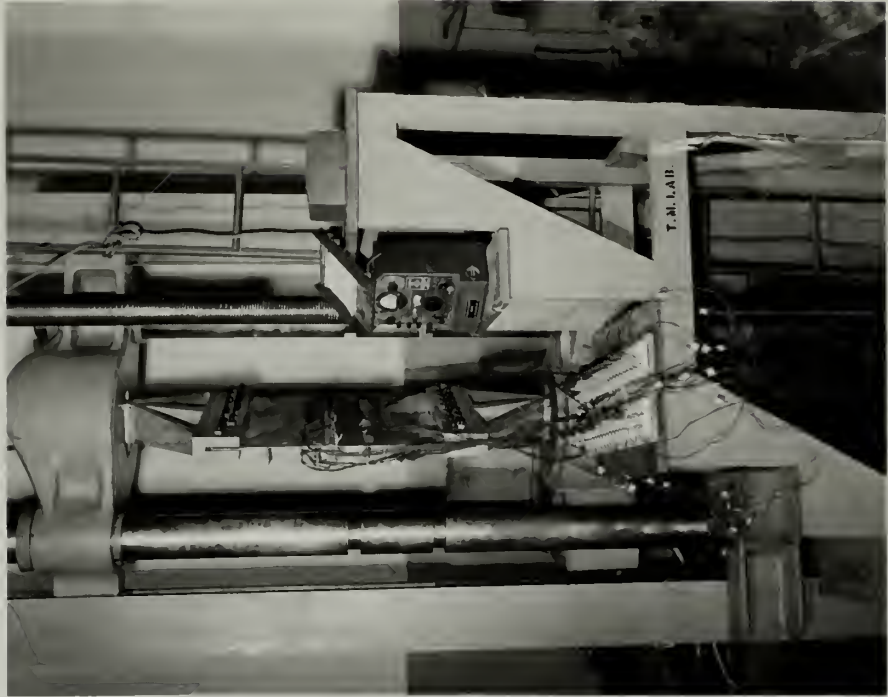


FIGURE XIV



Set-up of the Equipment



Hydraulic Testing Machine
Control Panel

strain reading at zero load, because of a probable change in the line-up of the specimen. This effect was particularly noticeable when the plate with 3/16" nominal deflection was tested.

2.8 Strain-Load Curves

The recorded strains were plotted against the applied load to check the correctness of the readings, as shown in Figures IV through XLIII. These curves represent the graphical average relation of strain to load at each strain gage position.

2.9 Strain Distribution Curves

From the Strain-Load curves, the strain at each strain gage was obtained for five levels of load, as recorded in Table IV in Appendix B. These strains were plotted against the positions of the strain gages to obtain the strain distribution curves at different levels of load for both the front face and the back face of the plate. The arithmetical mean average between both faces gave the strain values at the mid-depth of the panel. These values were also plotted against the position of the strain gages to obtain the strain distribution at the mid-depth of the plate. The strain distribution curves are shown in Figures XLIV through LVI.

2.10 Strain-Deflection Relationship

The arithmetical mean average of the strain distribution curve at the mid-depth for each specimen was taken as the average strain in the plate. This value is different from the strain that would be obtained by dividing the load by the product of the cross-sectional area times the modulus of elasticity of the material, assuming that the stiffeners shared the load.

strain reading at zero load, because of a possible change in the line-up of the specimen. This effect was particularly noticeable when the plate with $3/16$ " nominal deflection was tested.

2.8 Strain-Load Curves

The recorded strains were plotted against the applied load to obtain the correctness of the readings, as shown in Figure IV through VIII. These curves represent the graphical average relation of strain to load at each strain gage position.

2.9 Strain Distribution Curves

From the Strain-Load curves, the strain at each strain gage was obtained for five levels of load, as recorded in Table IV in Appendix B. These strains were plotted against the positions of the strain gages to obtain the strain distribution curves at different levels of load for both the front face and the back face of the plate. The arithmetical mean average between both faces gave the strain values at the mid-depth of the panel. These values were also plotted against the position of the strain gages to obtain the strain distribution at the mid-depth of the plate. The strain distribution curves are shown in Figure VIII through XVI.

2.10 Strain-Deflection Relationship

The arithmetical mean average of the strain distribution curve at the mid-depth for each specimen was taken as the average strain in the plate. This value is different from the strain that would be obtained by dividing the load by the product of the cross-sectional area times the modulus of elasticity of the material, assuming that the stresses shared the load.

FIGURE XV

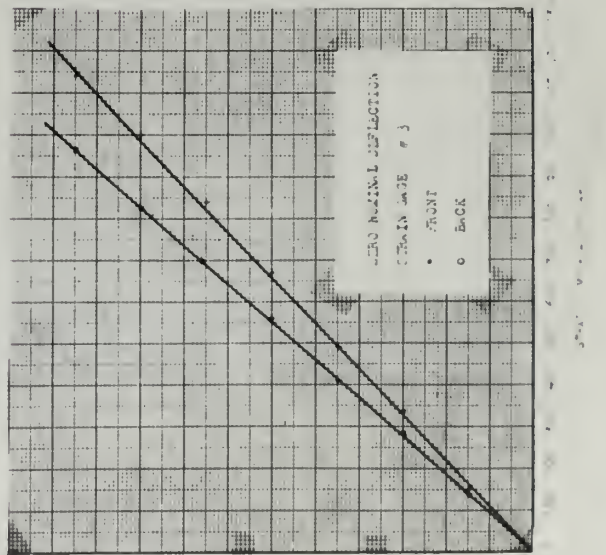
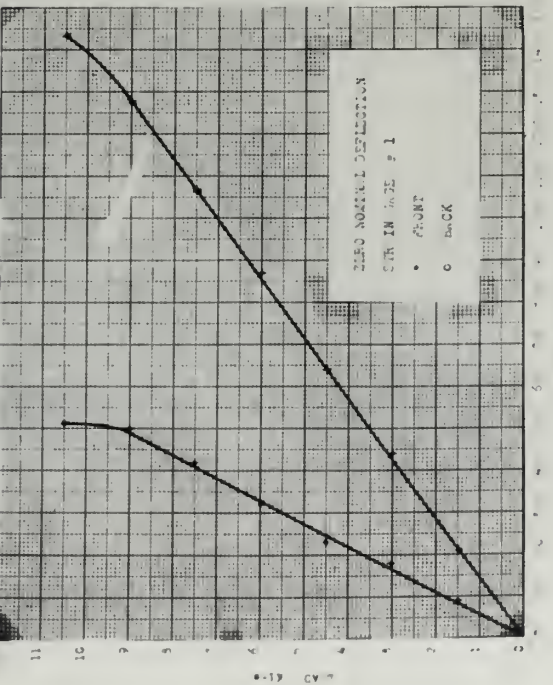
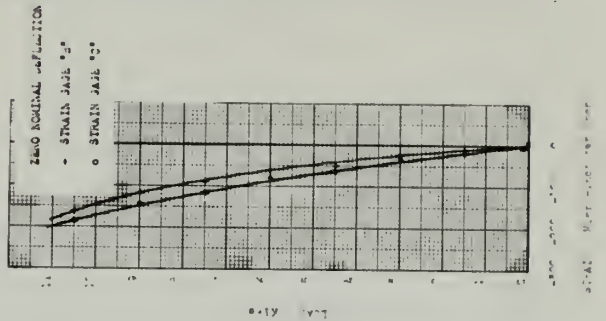
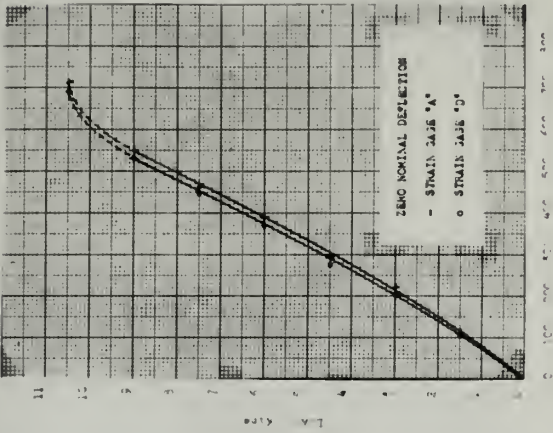
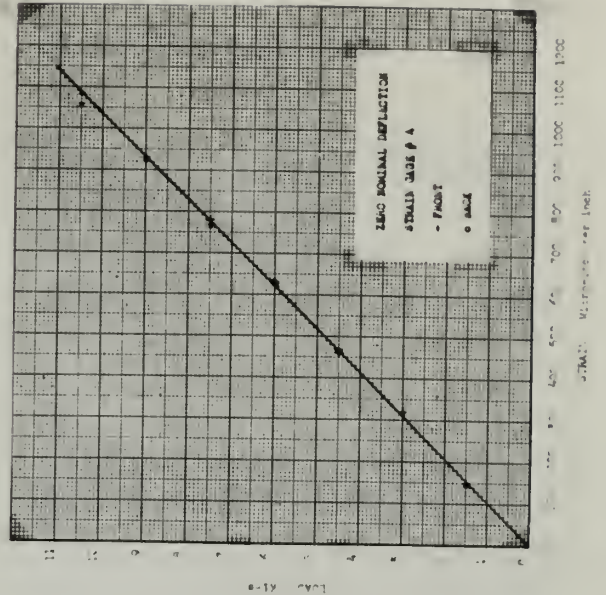
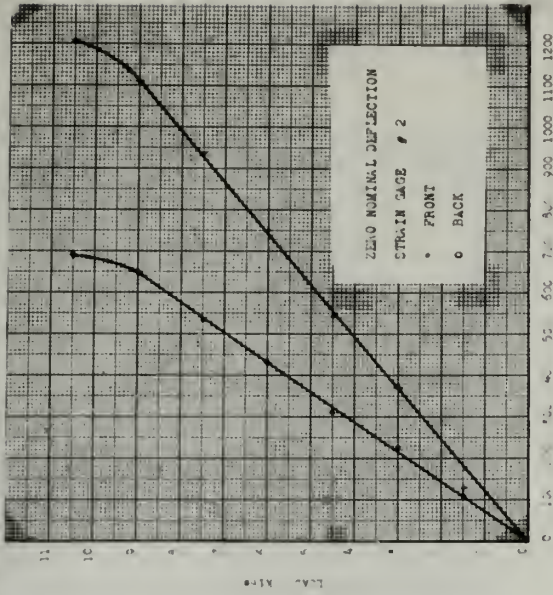


FIGURE XVI

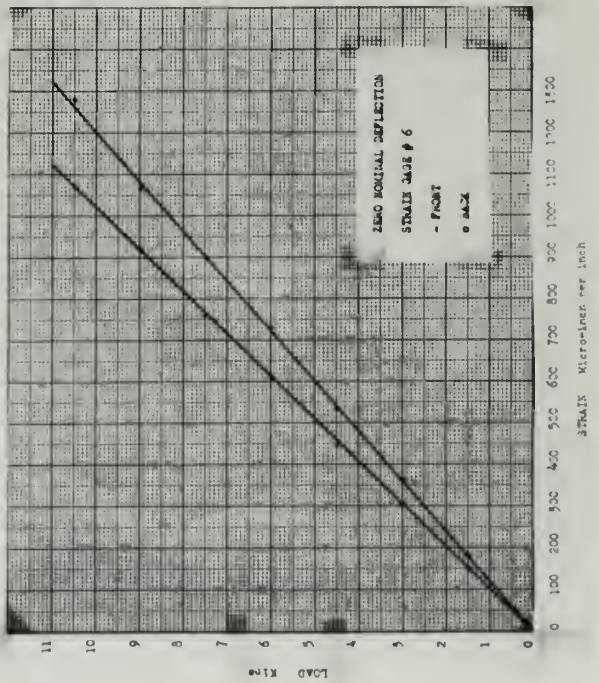
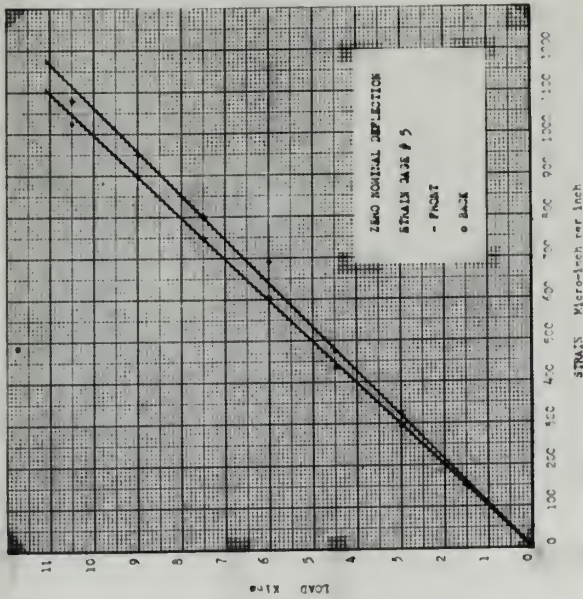
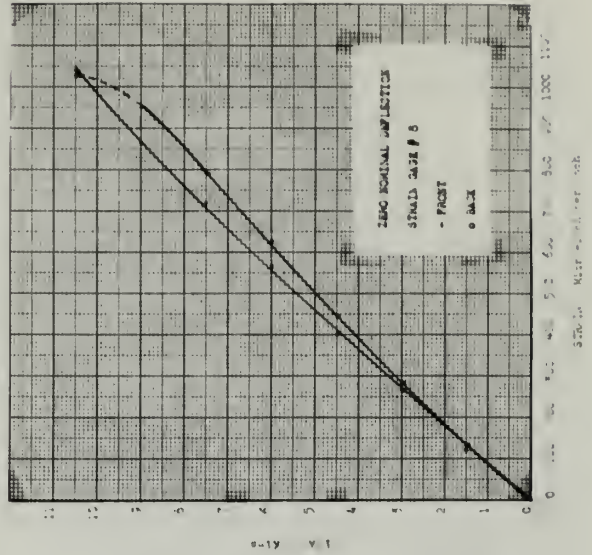
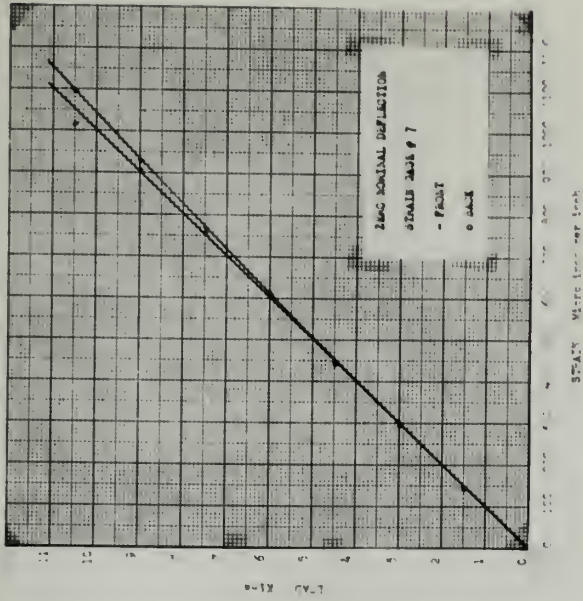


FIGURE XVII

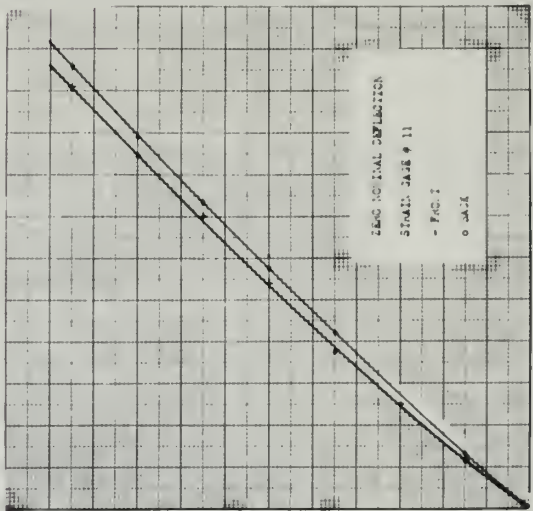
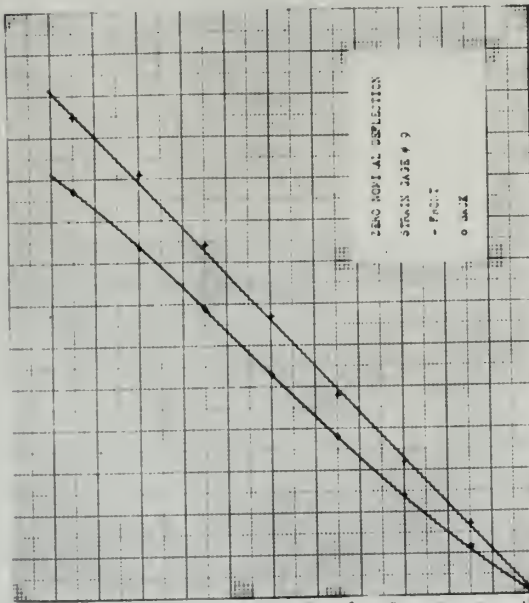
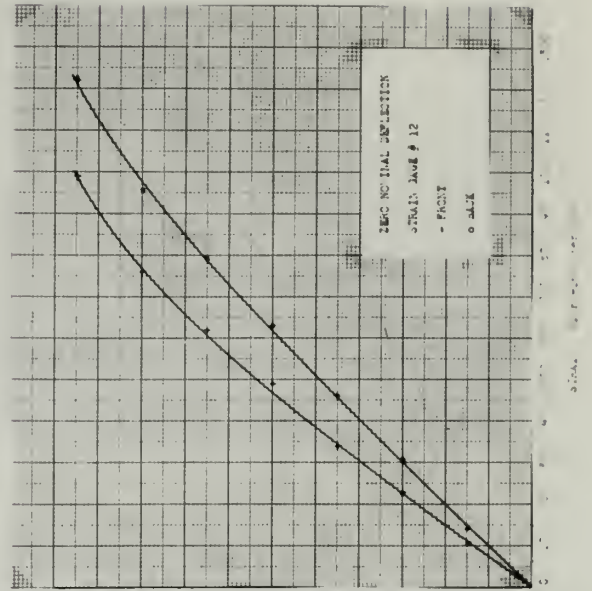
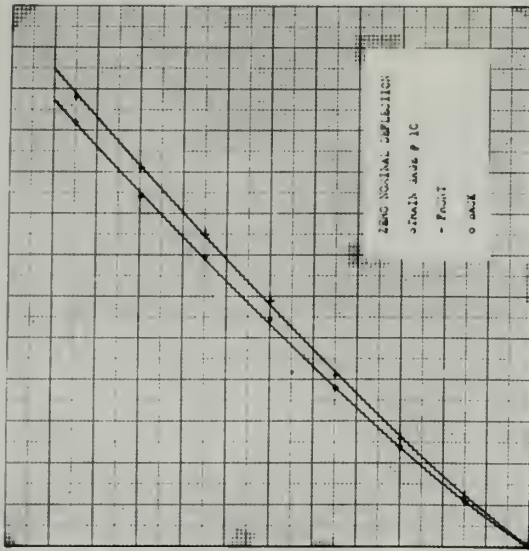


FIGURE XVIII

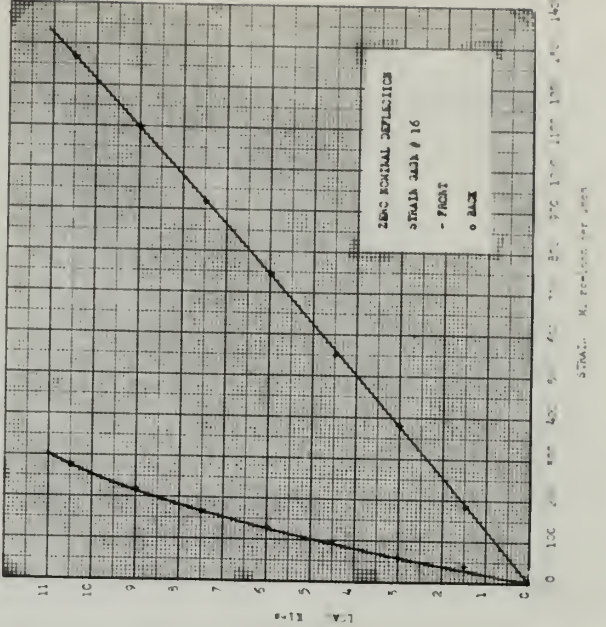
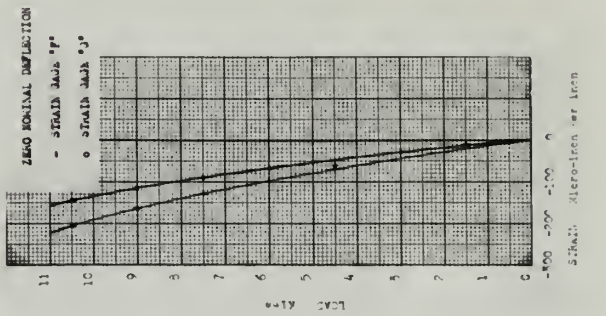
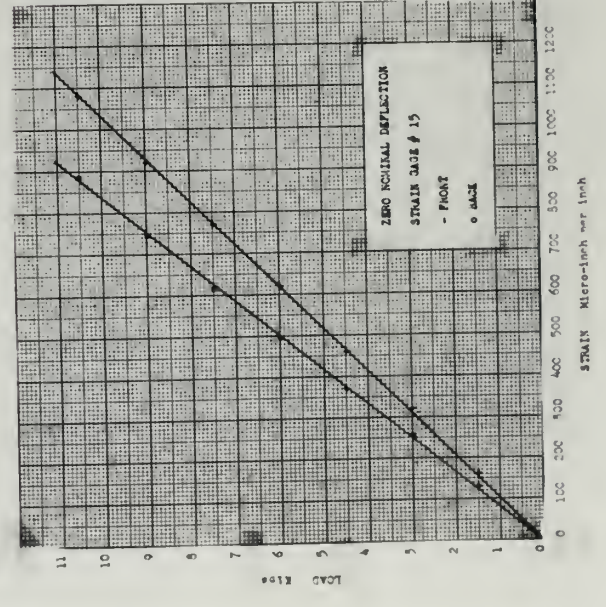
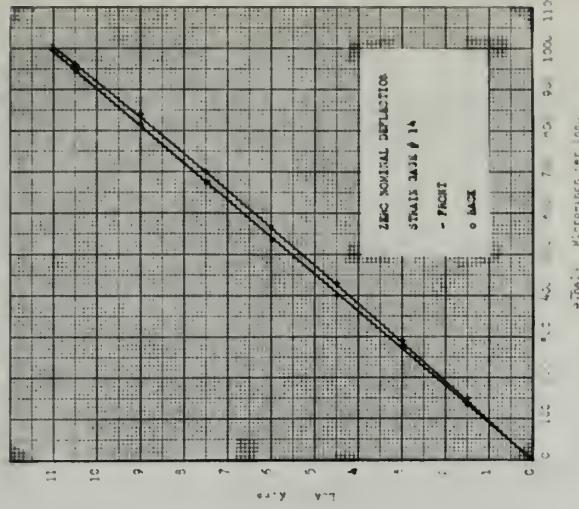
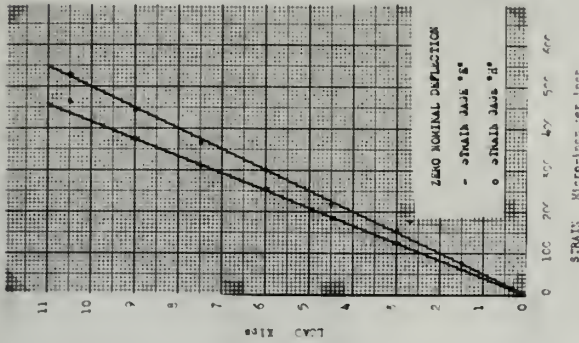
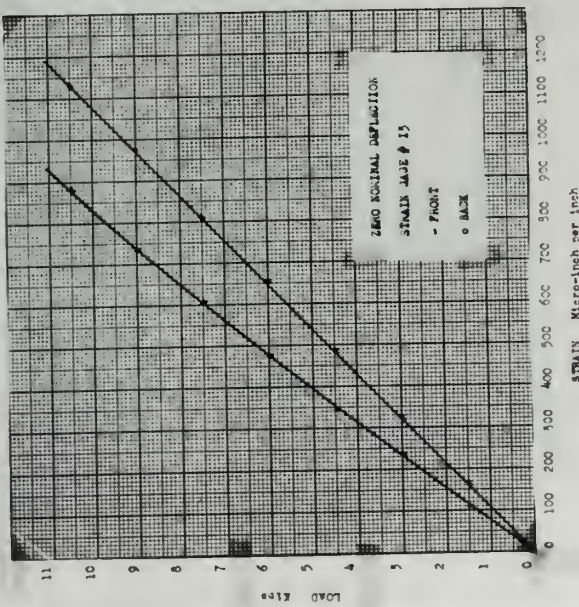


FIGURE XIX

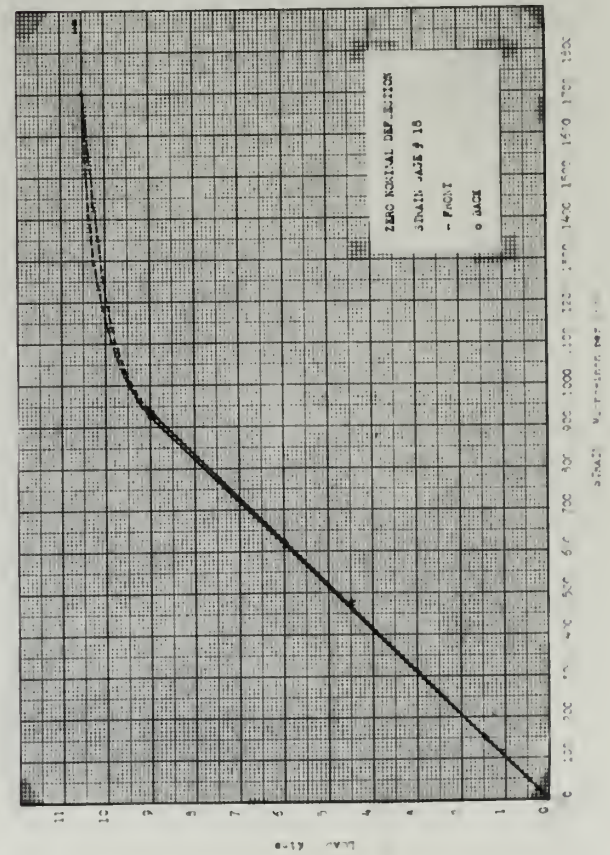
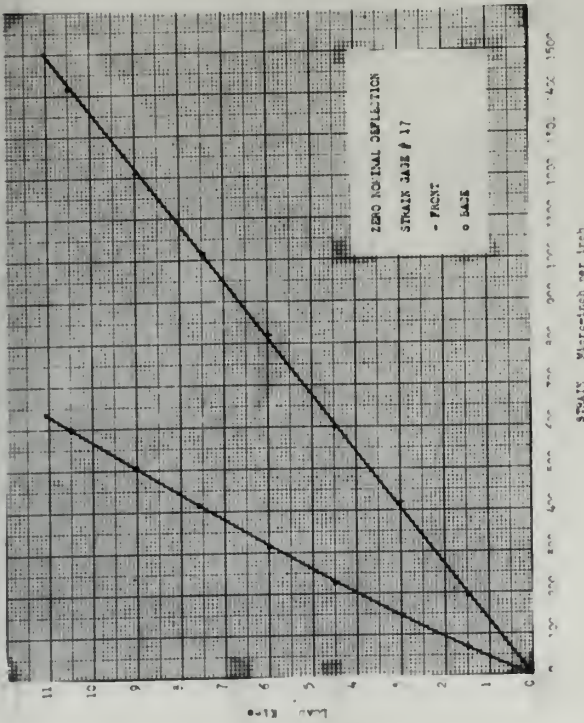
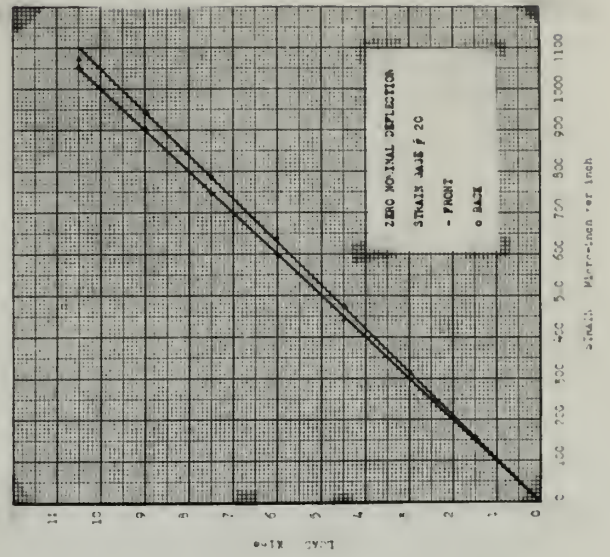
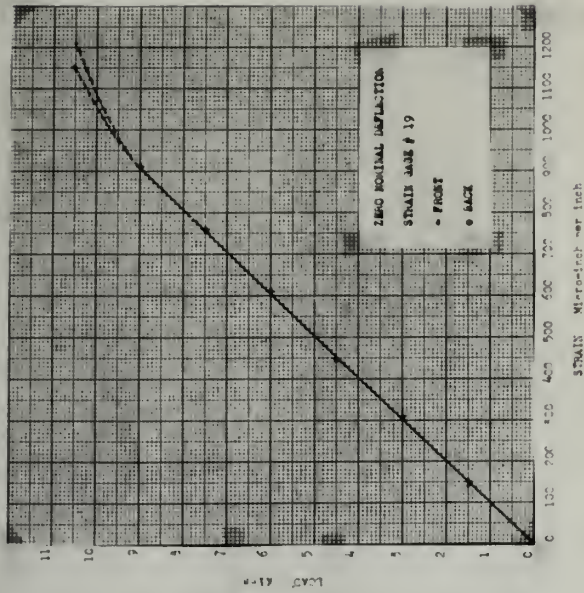


FIGURE XX

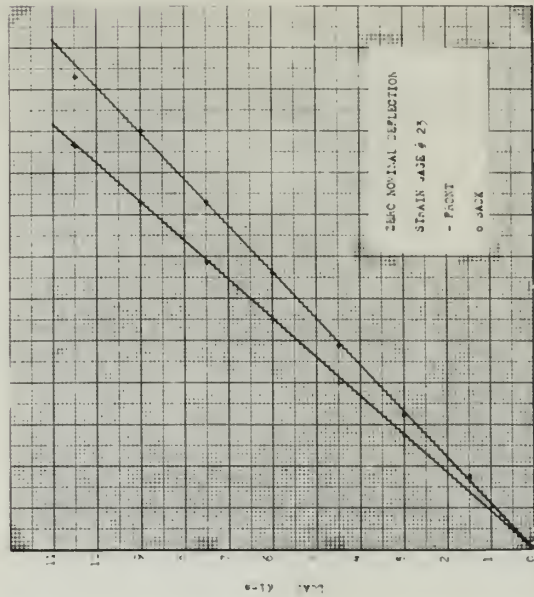
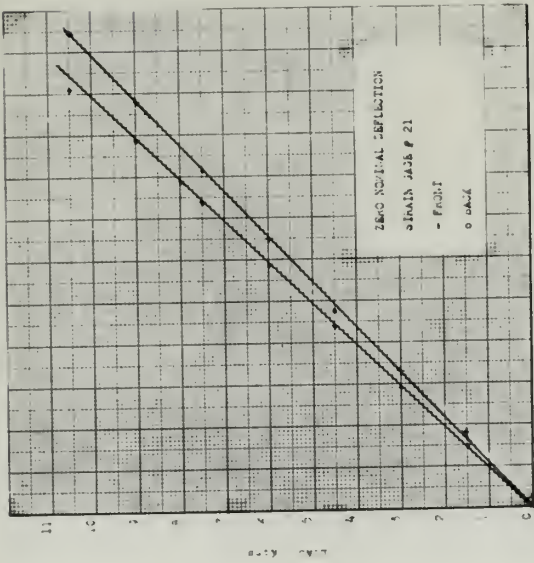
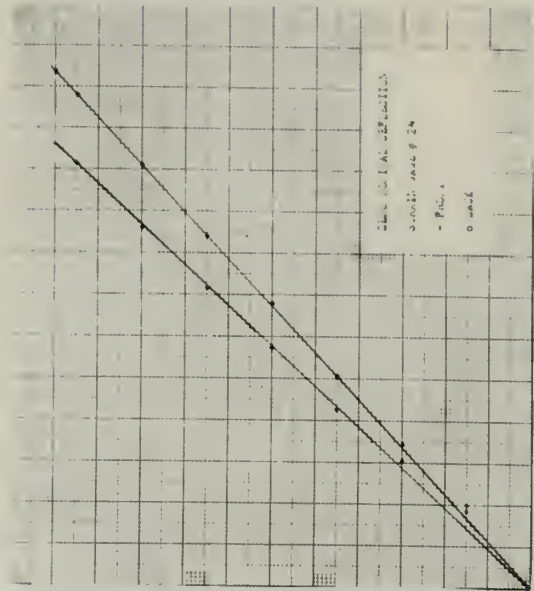
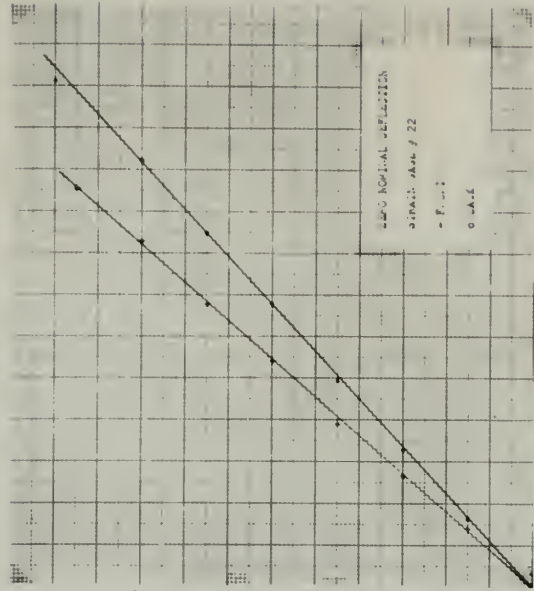


FIGURE XXI

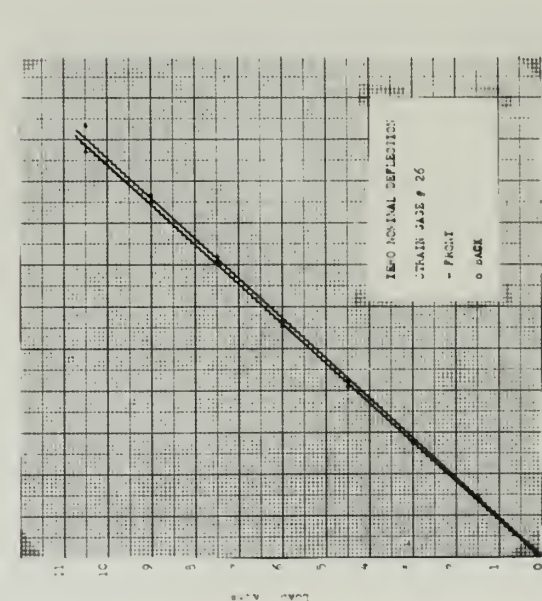
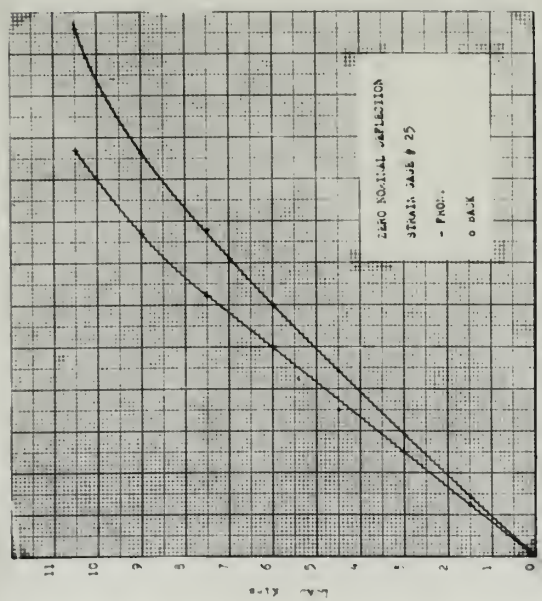
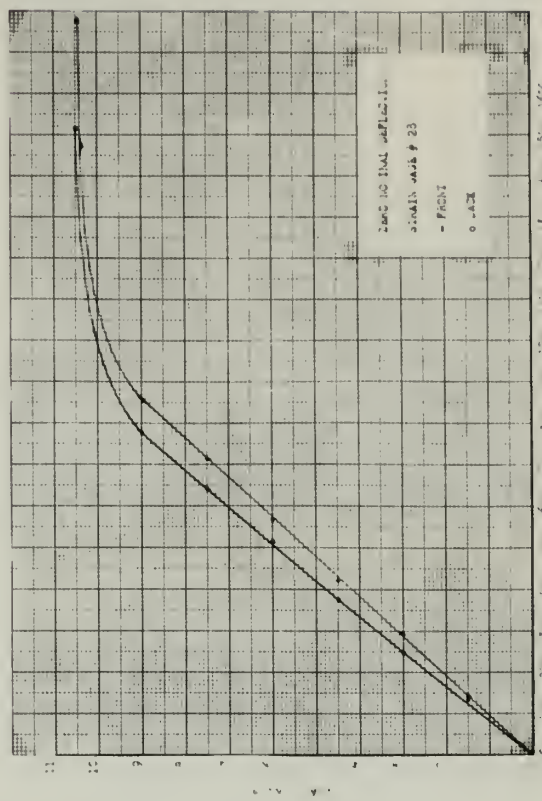
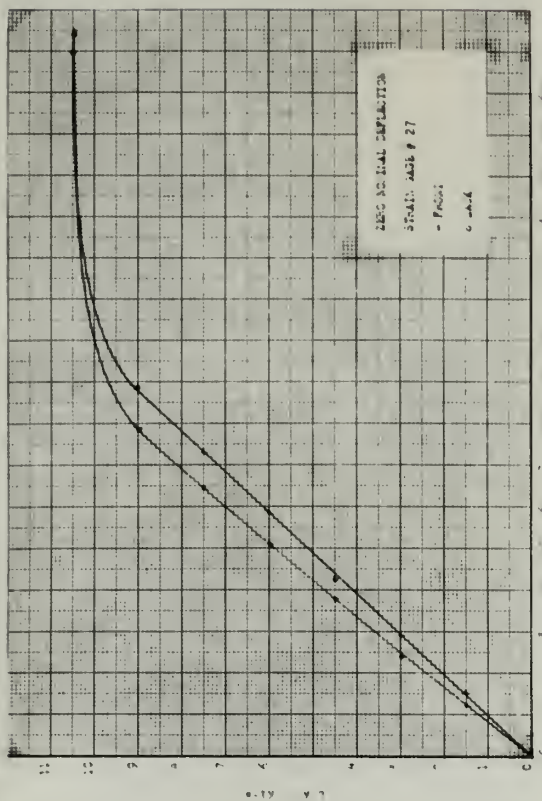


FIGURE XXII

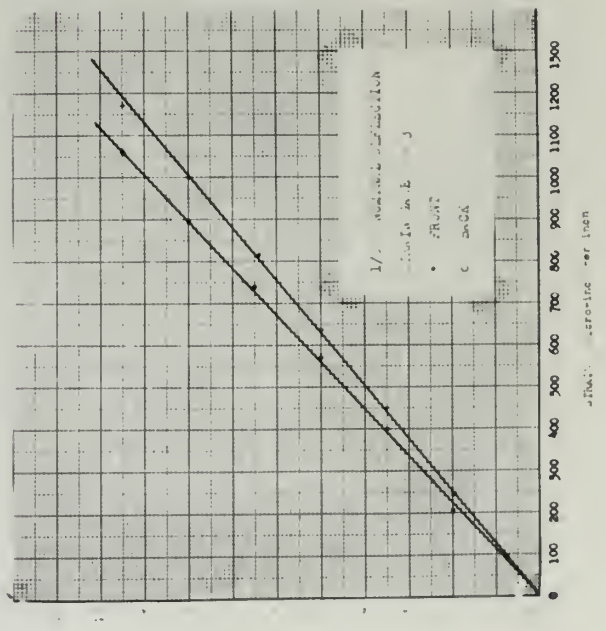
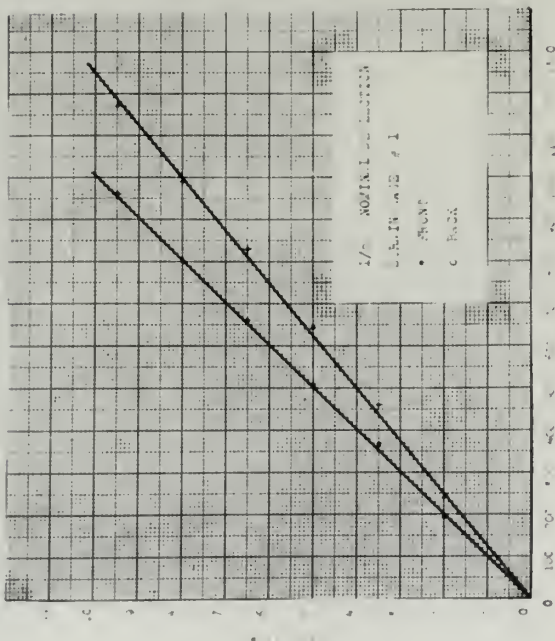
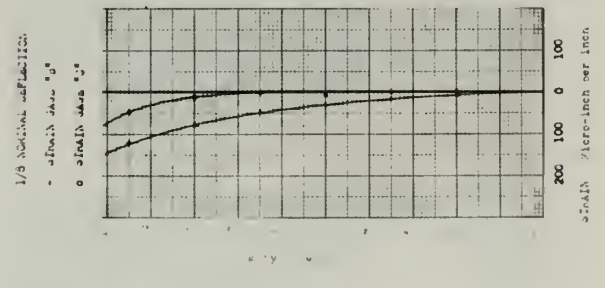
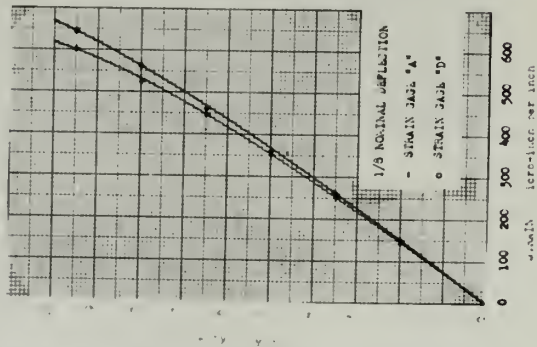
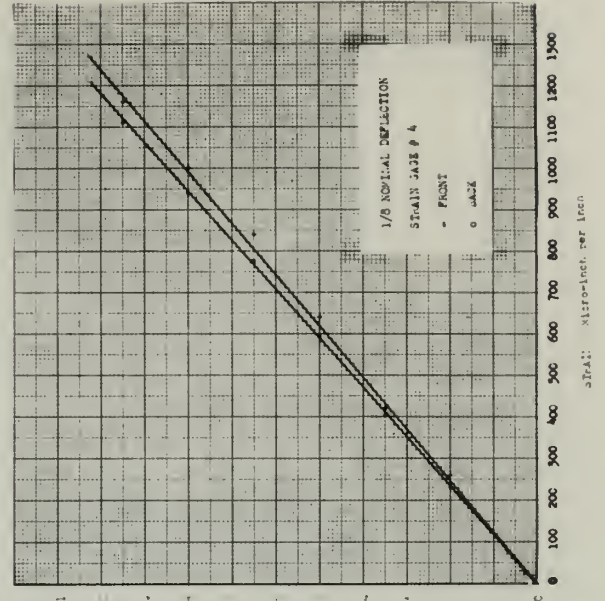
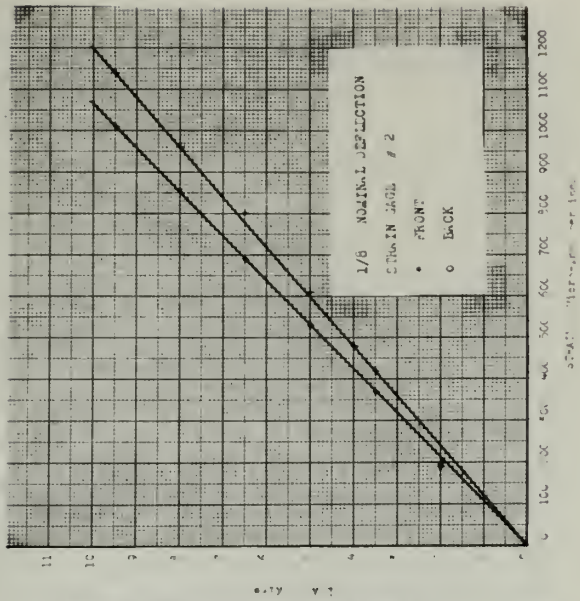


FIGURE XXIII

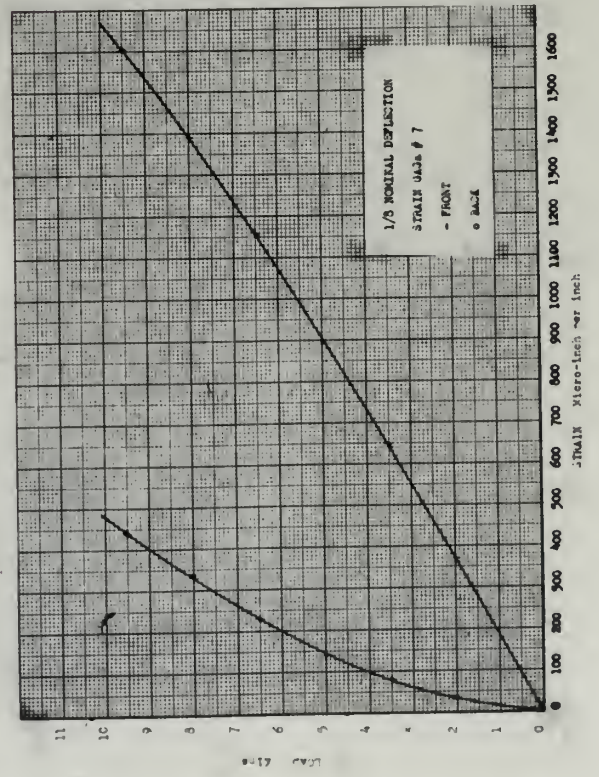
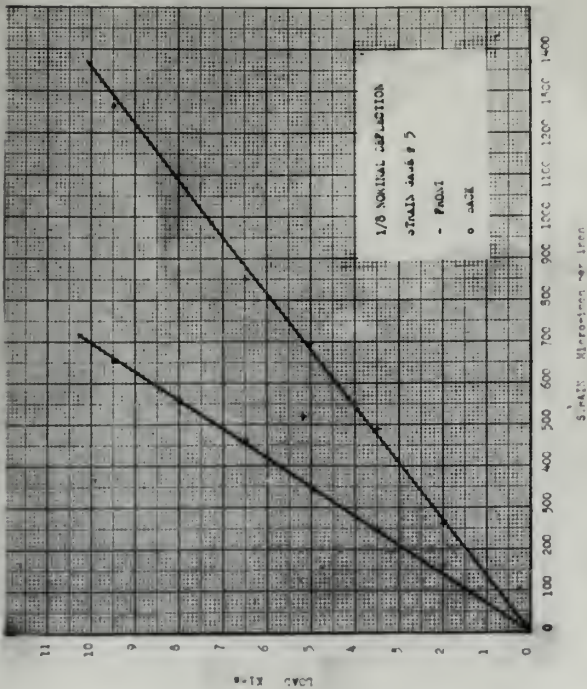
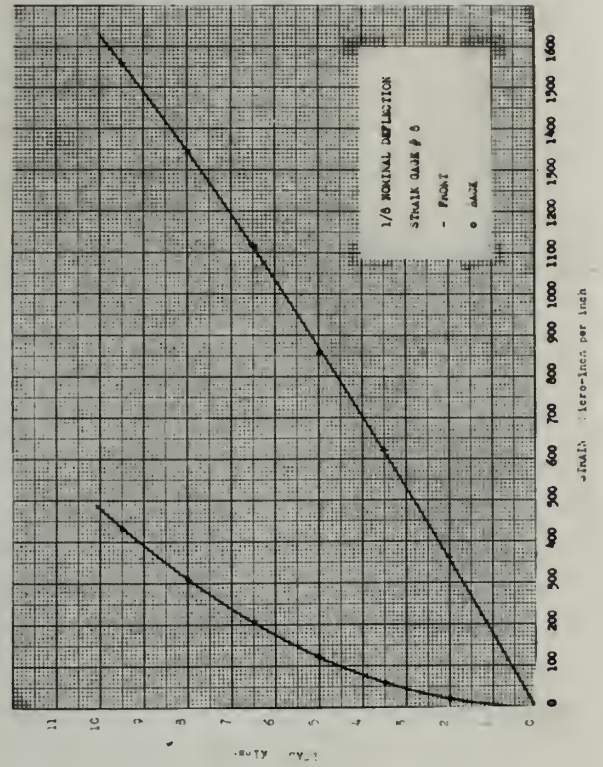
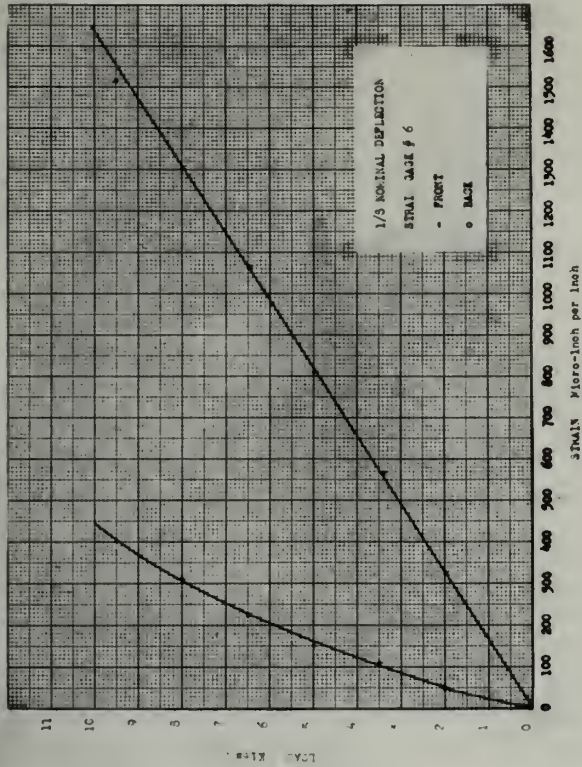


FIGURE XXIV

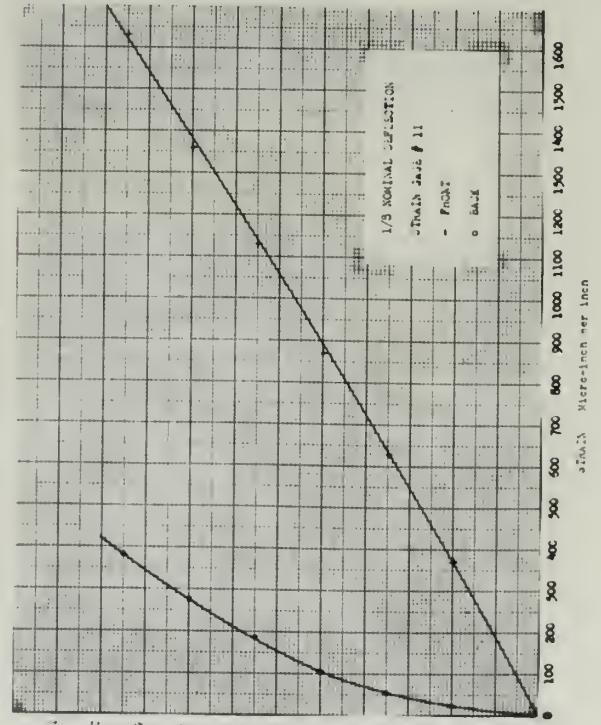
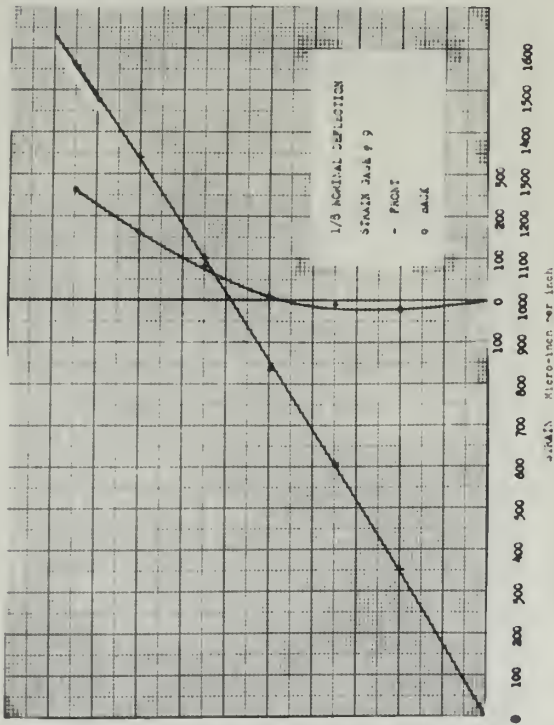
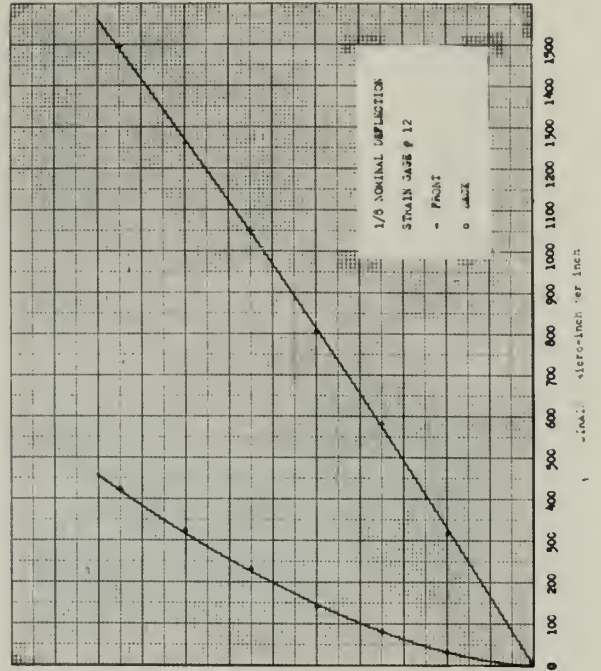
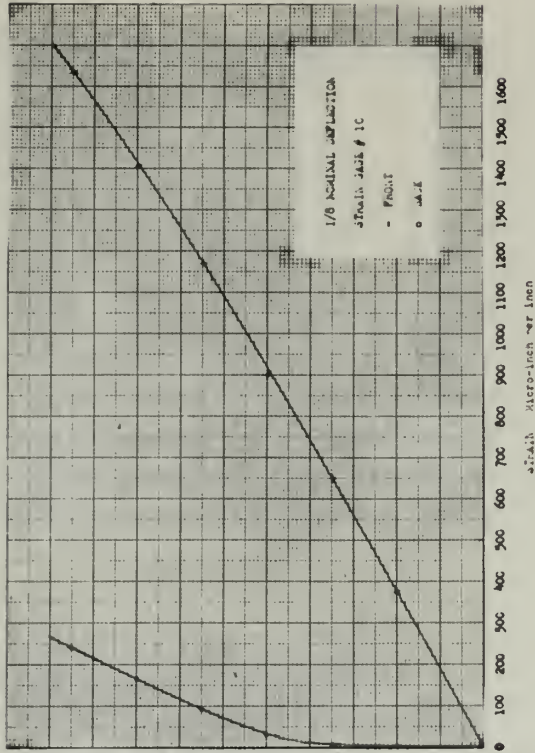


FIGURE XXV

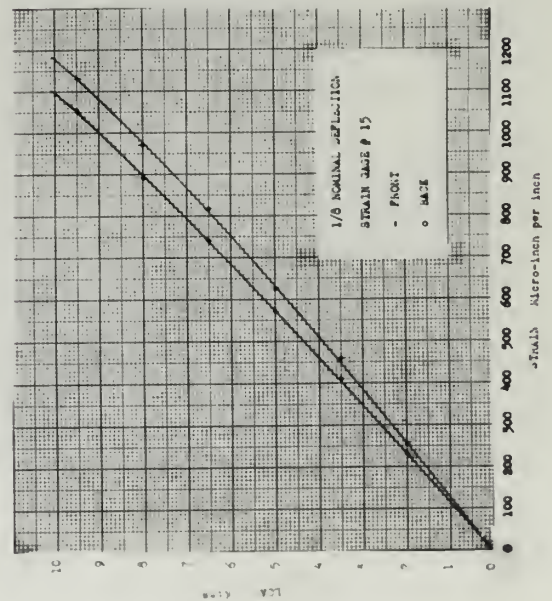
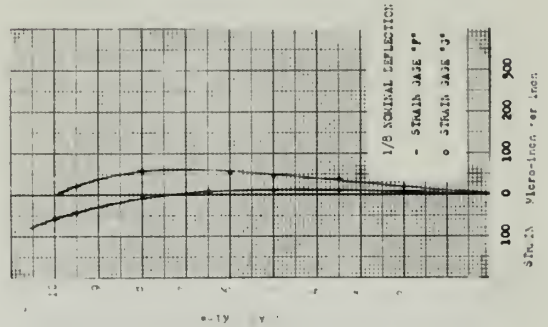
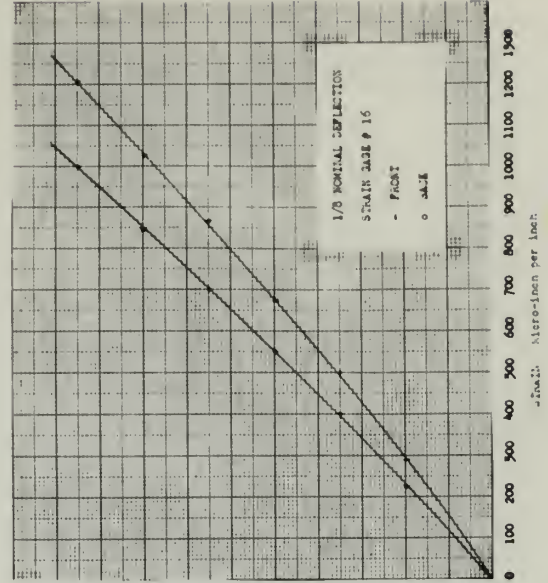
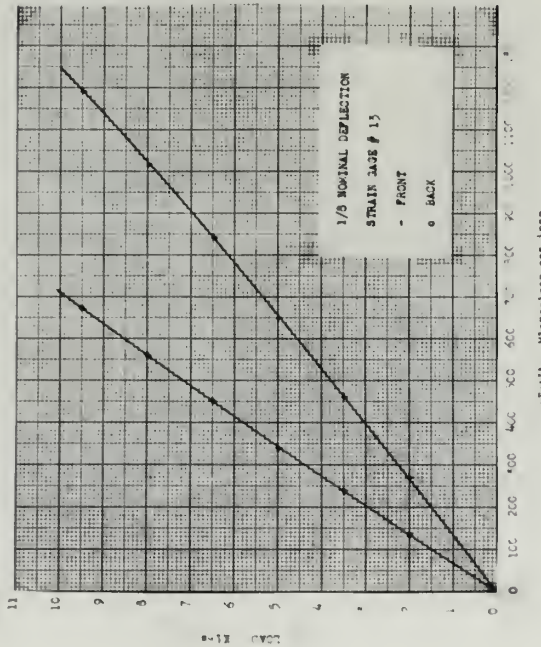
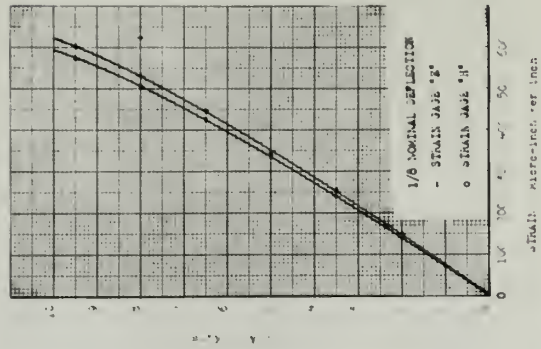
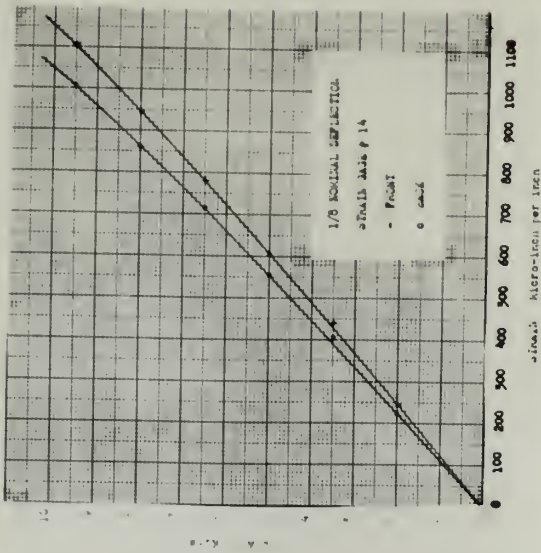


FIGURE XXVI

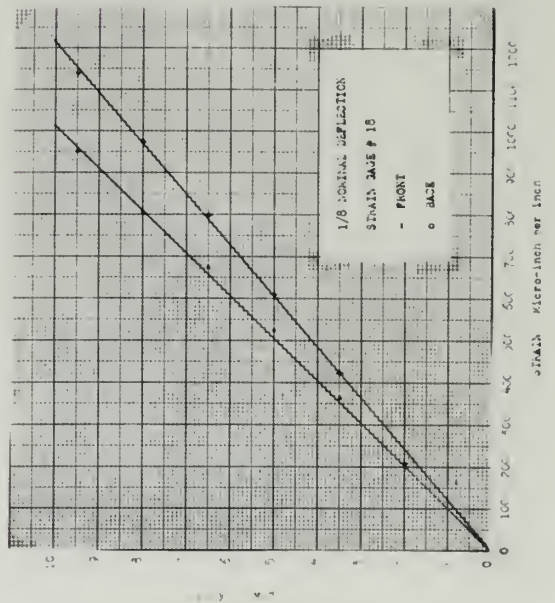
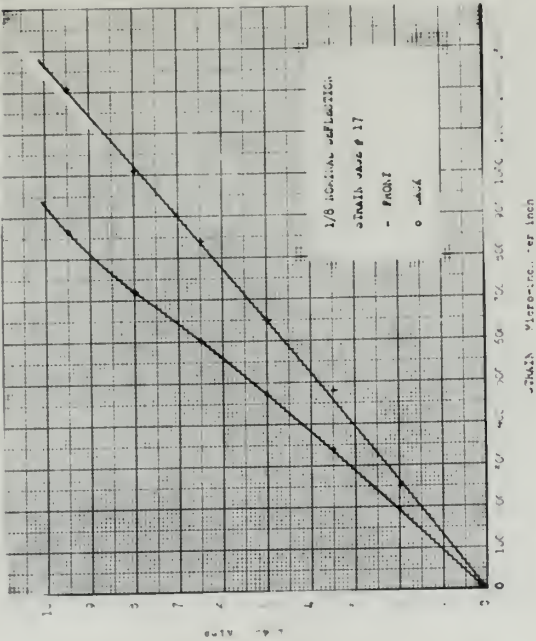
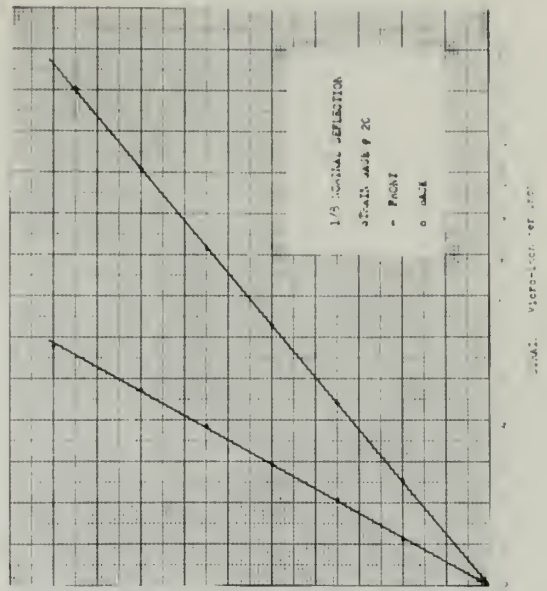
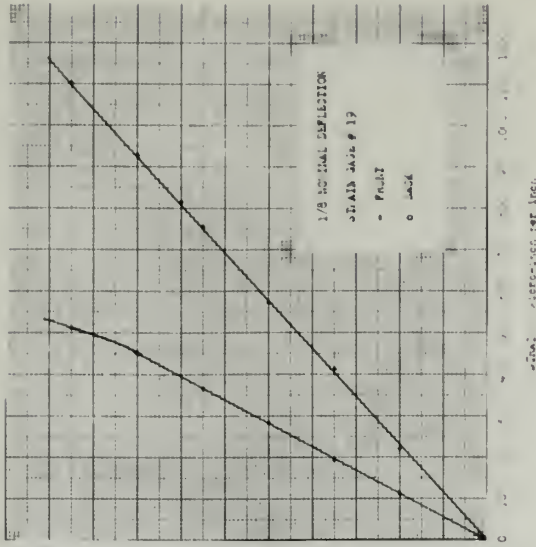


FIGURE XVII

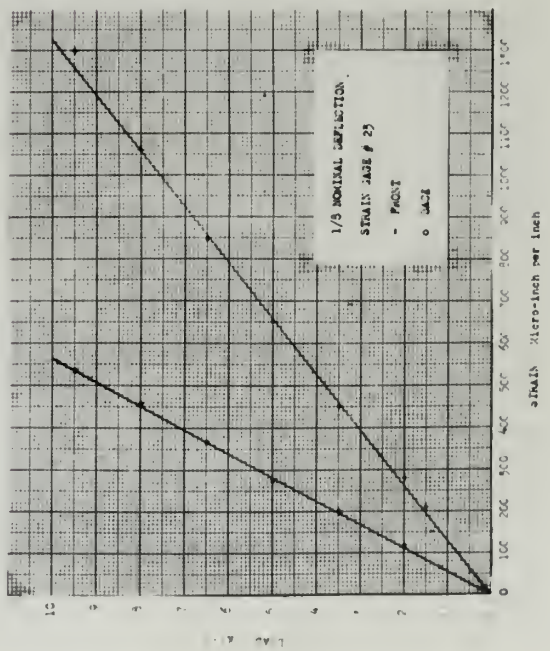
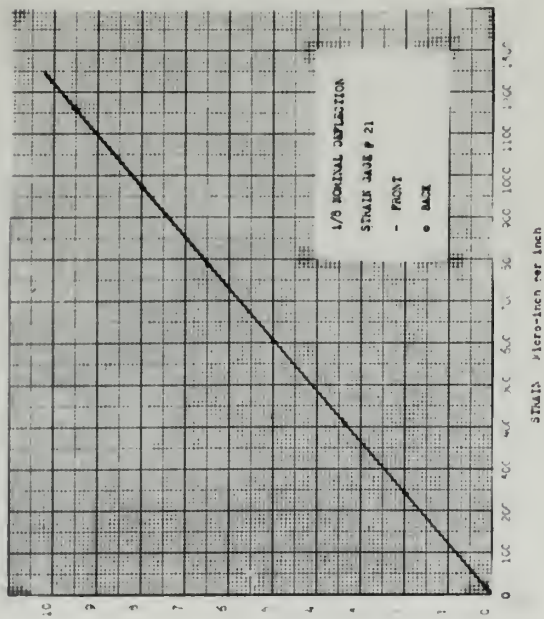
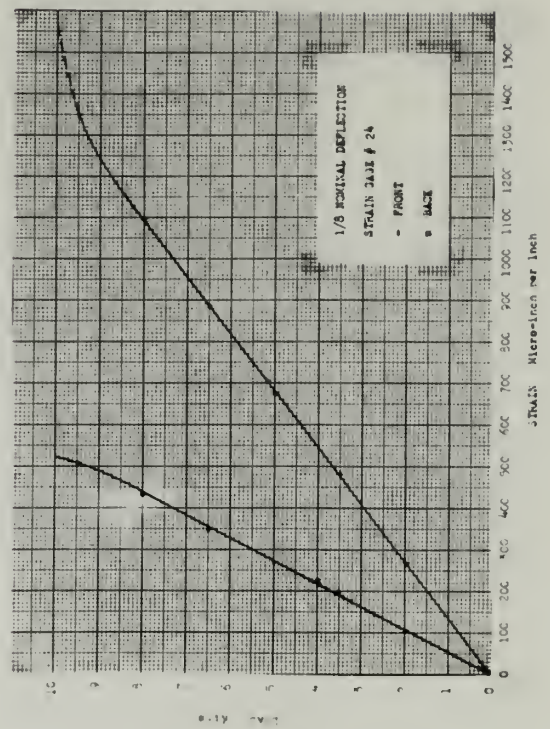
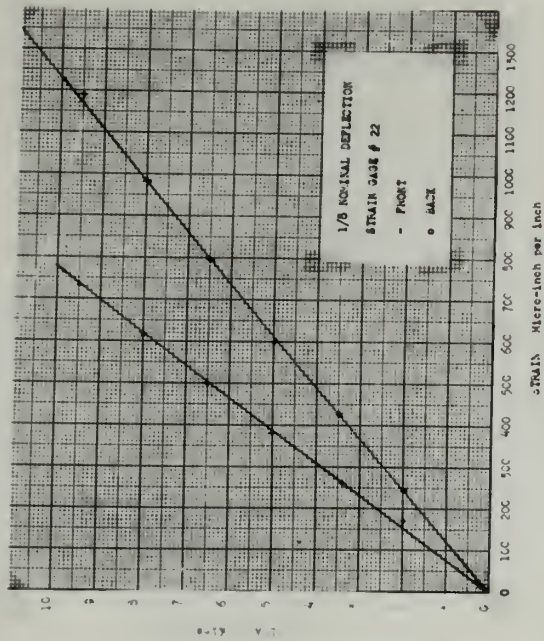


FIGURE XXVIII

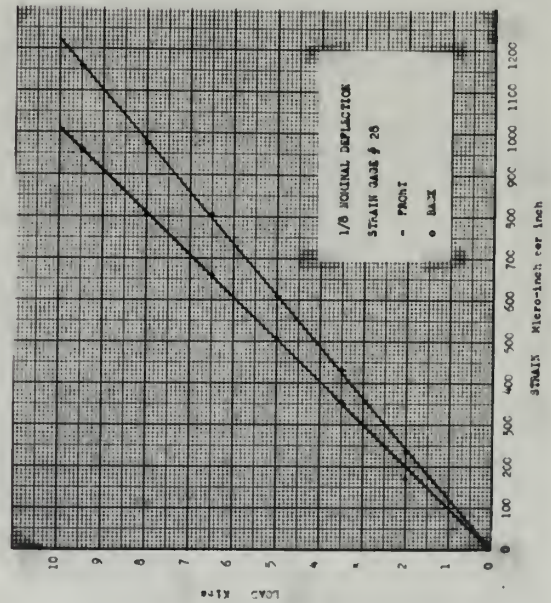
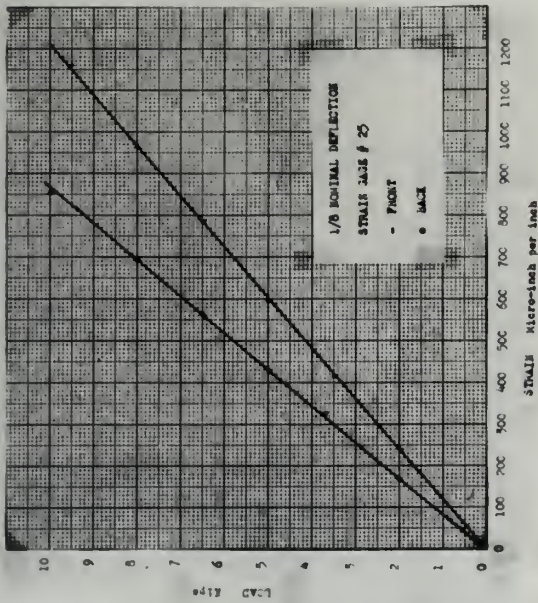
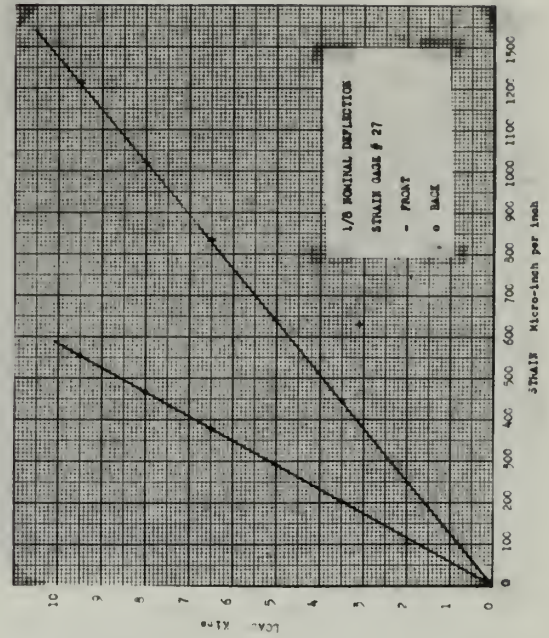
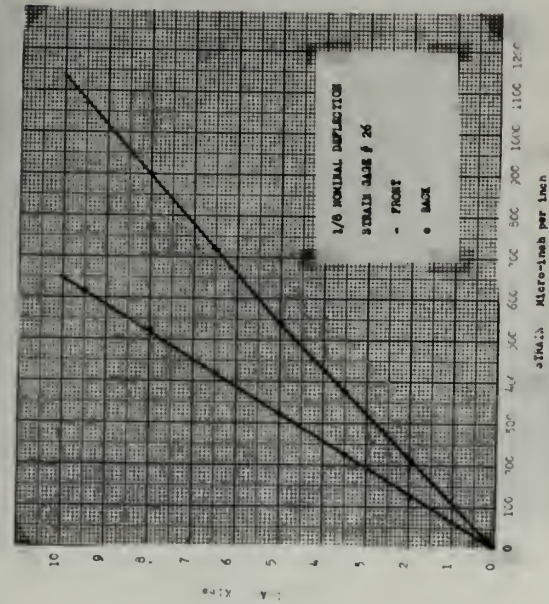
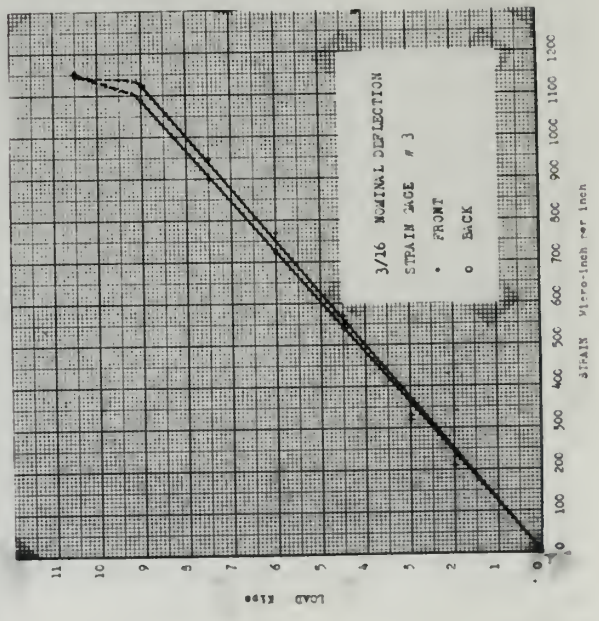
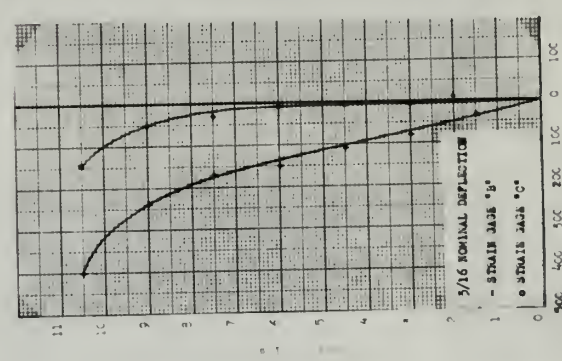
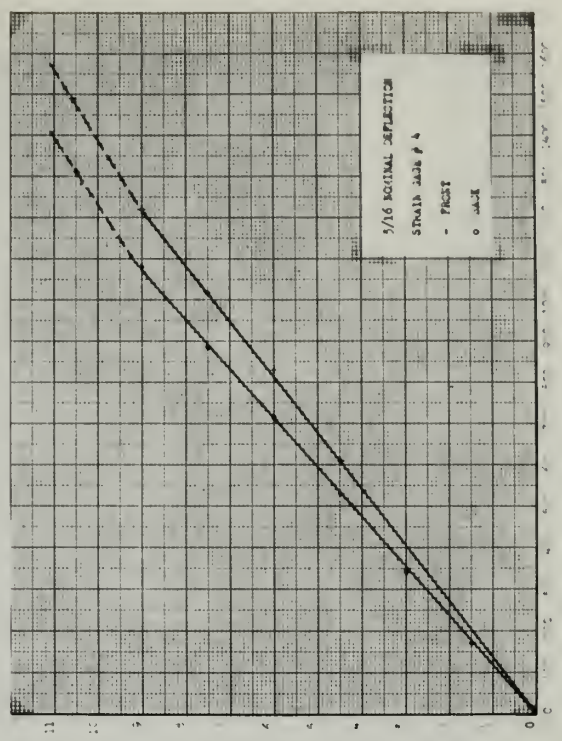
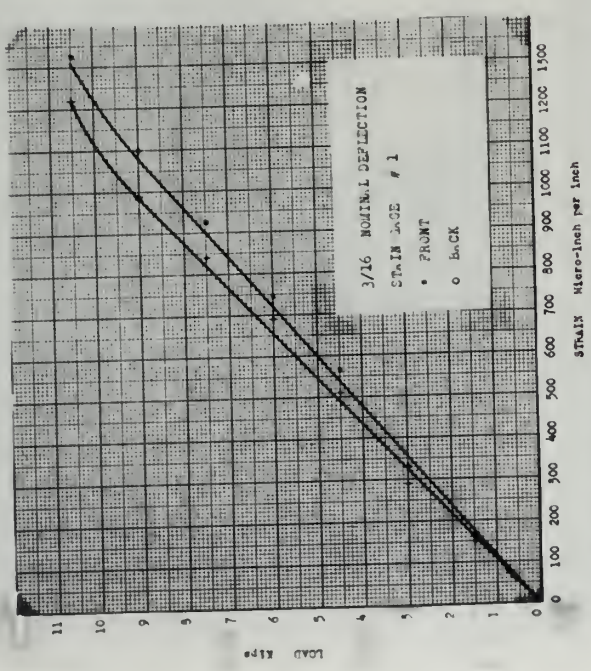
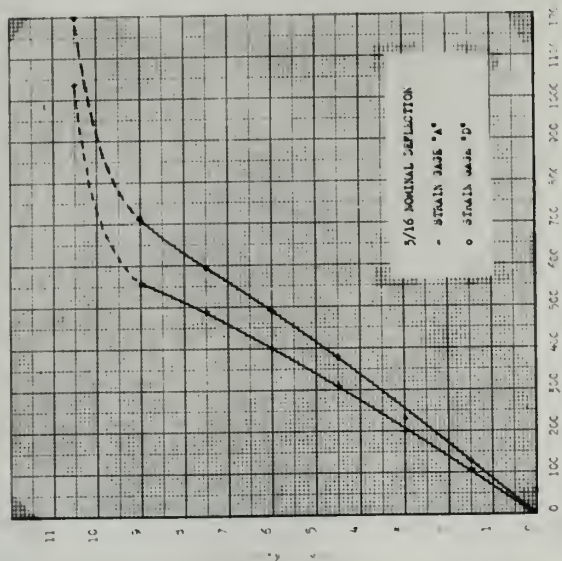
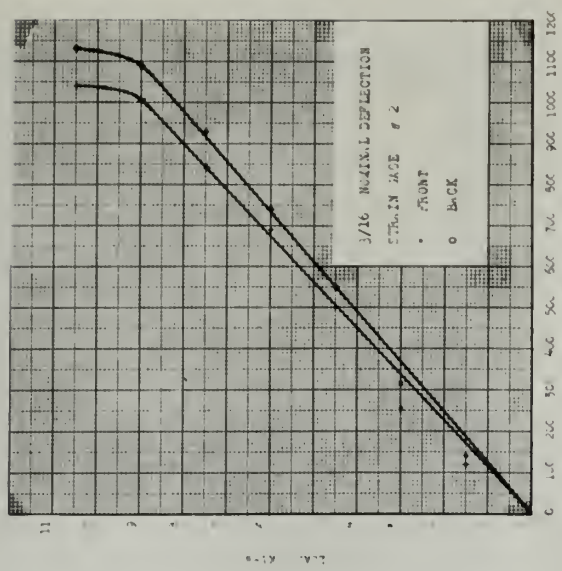
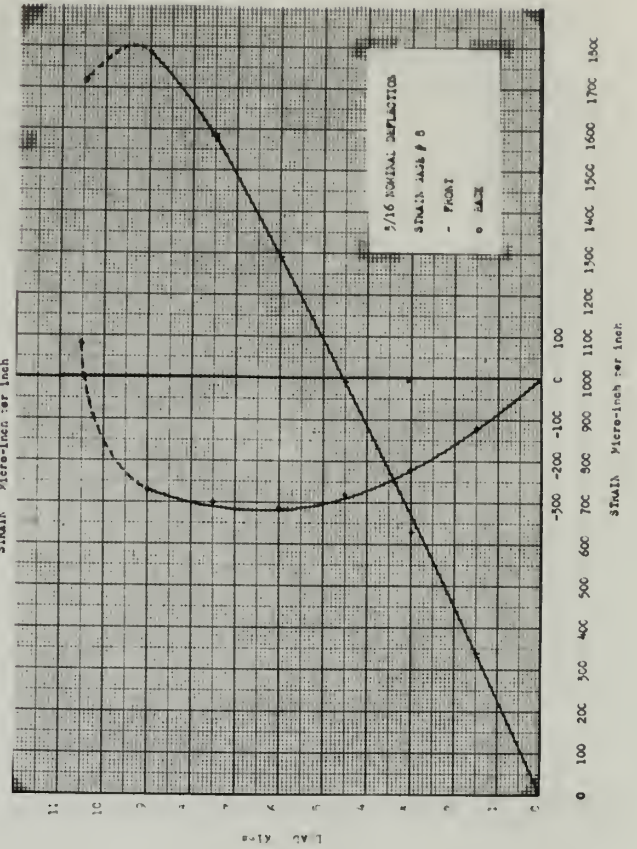
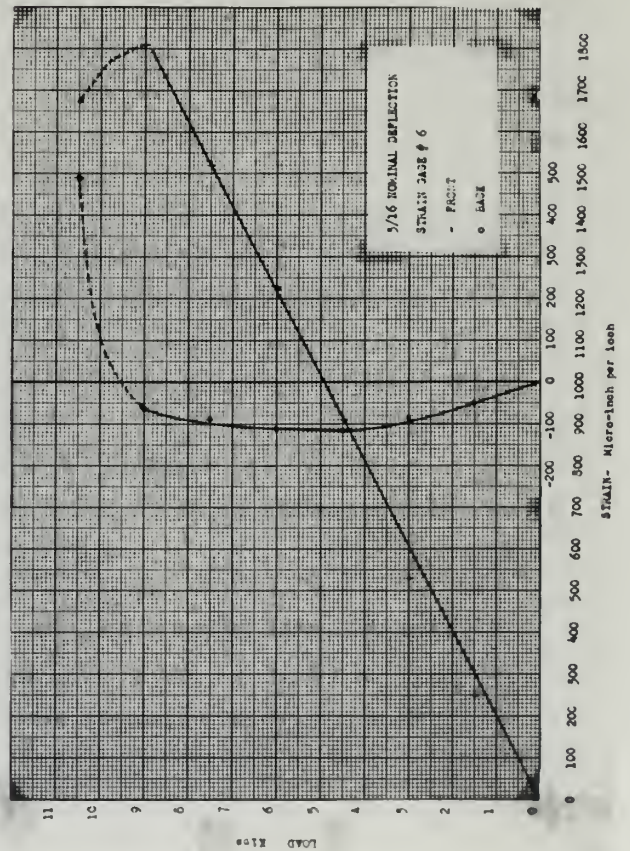
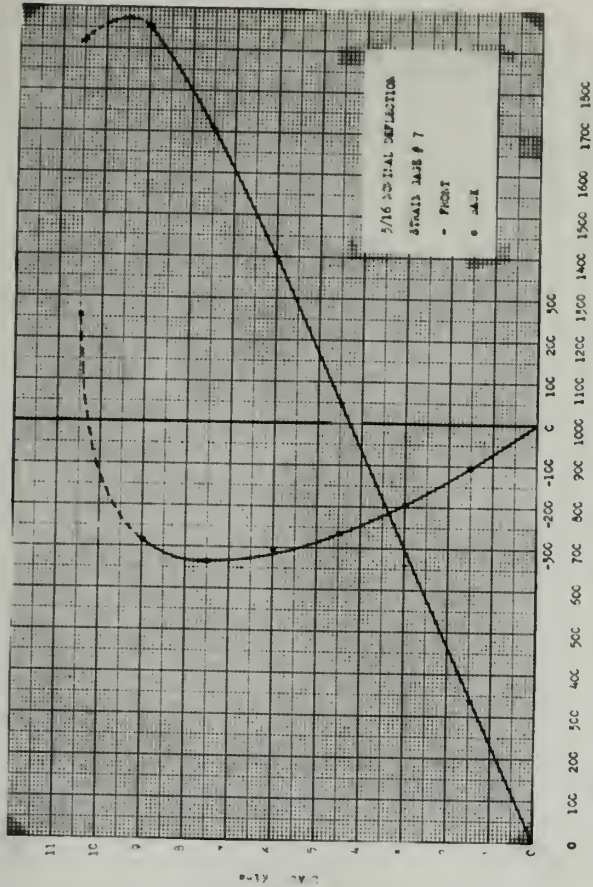
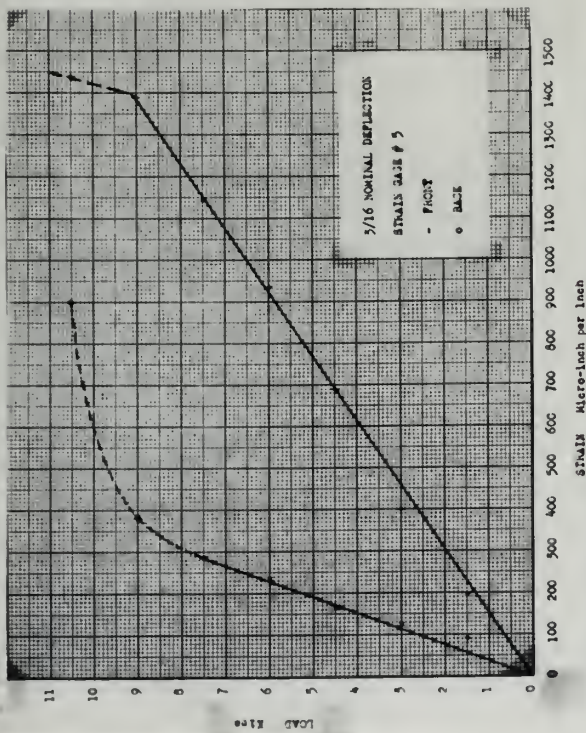
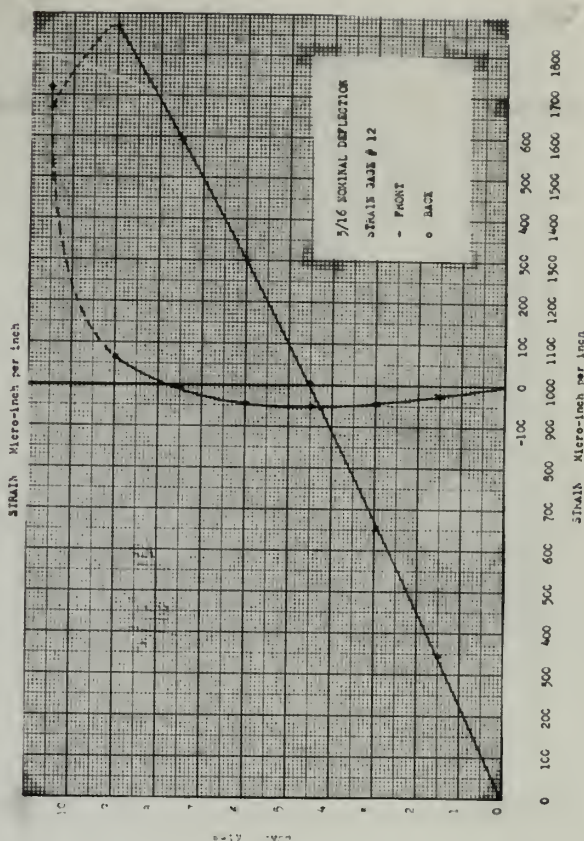
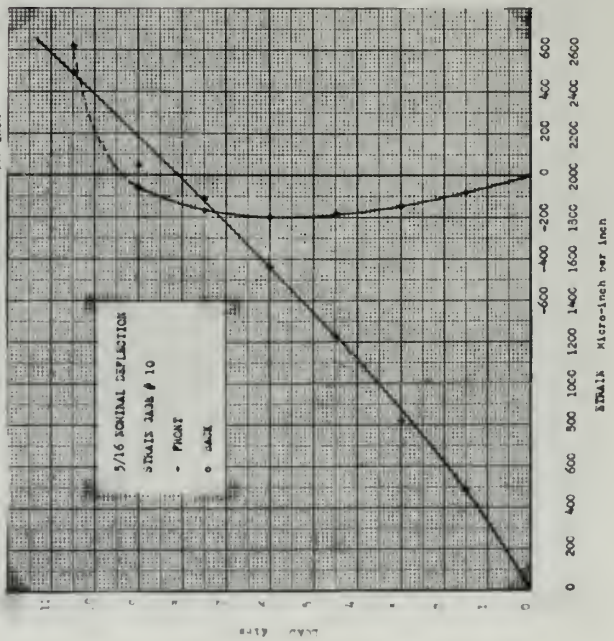
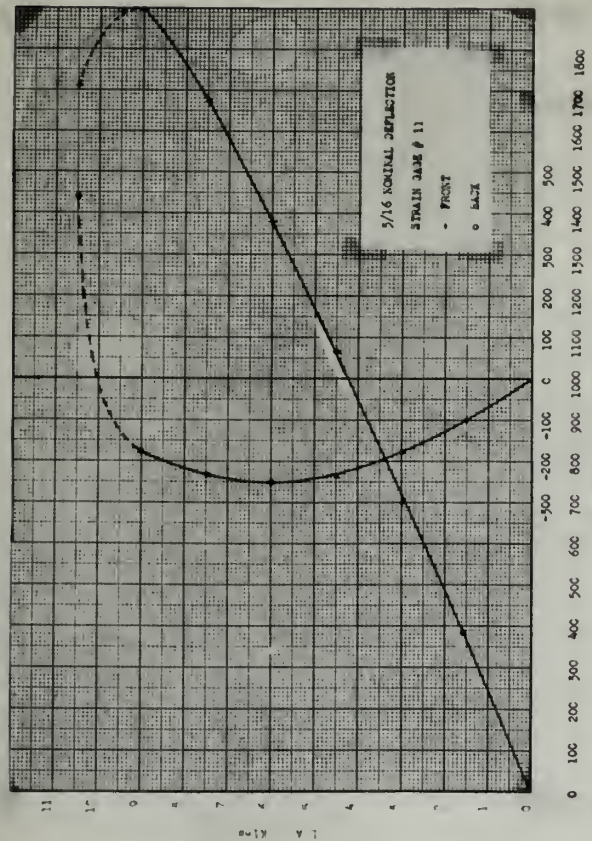
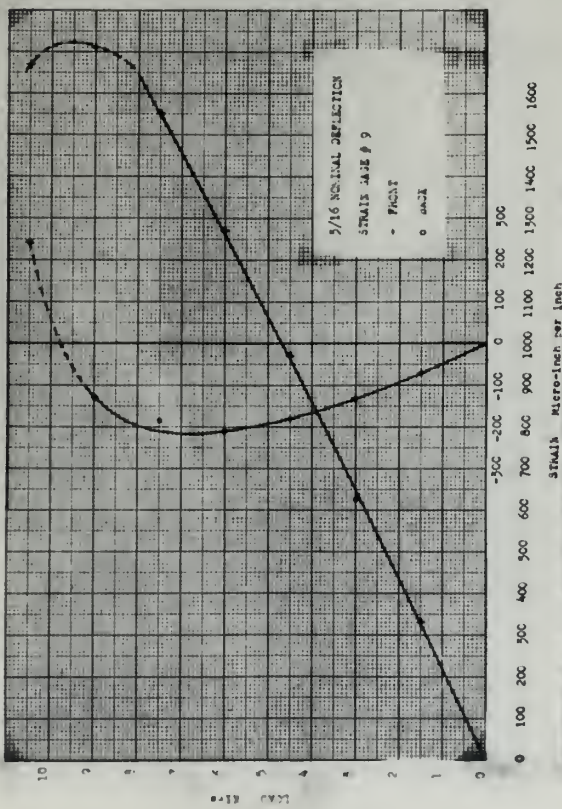


FIGURE XXIX







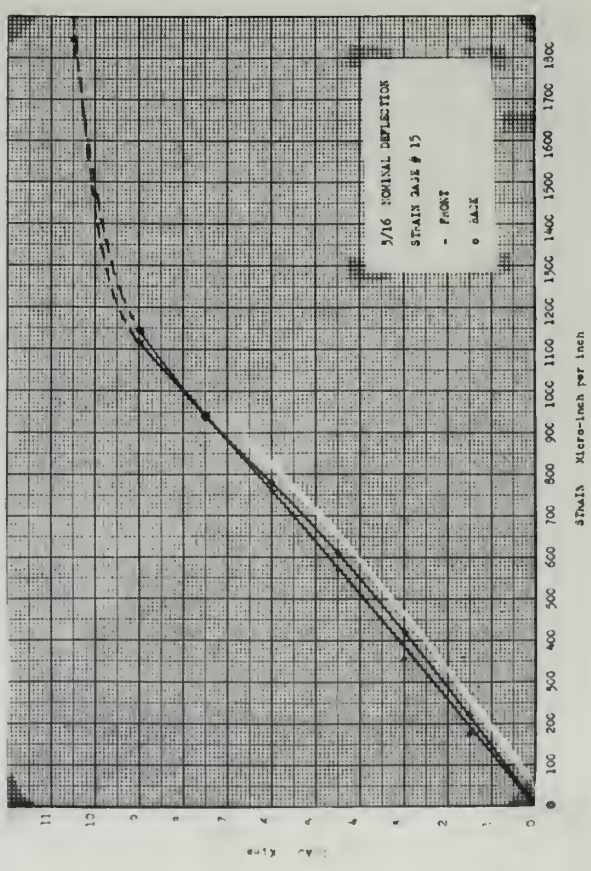
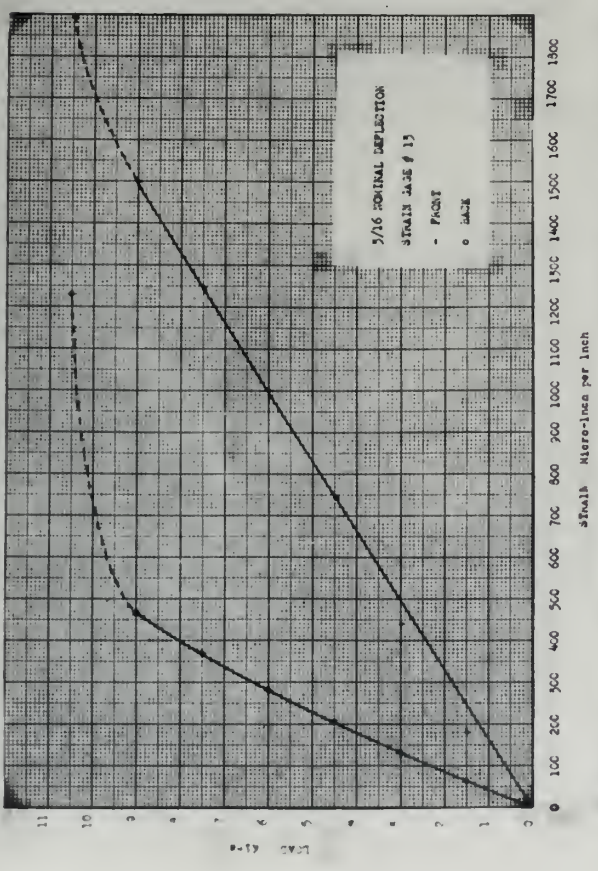
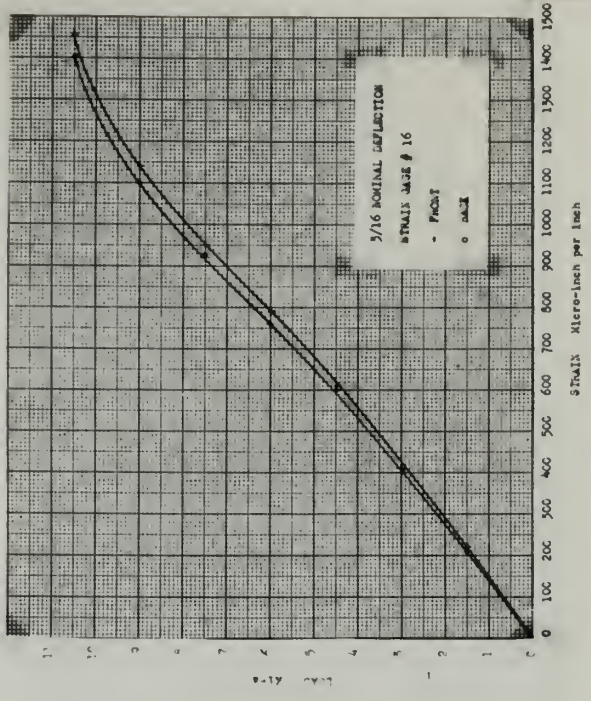
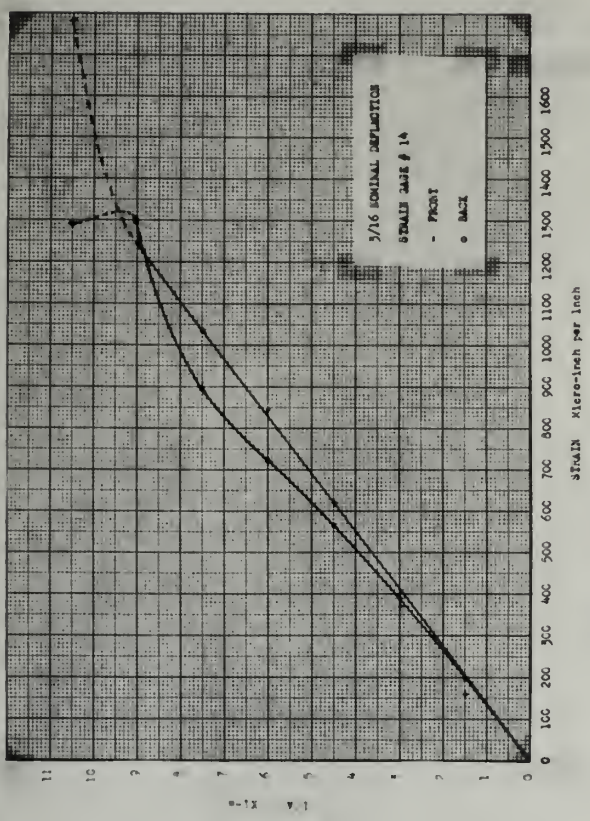


FIGURE XXXIII

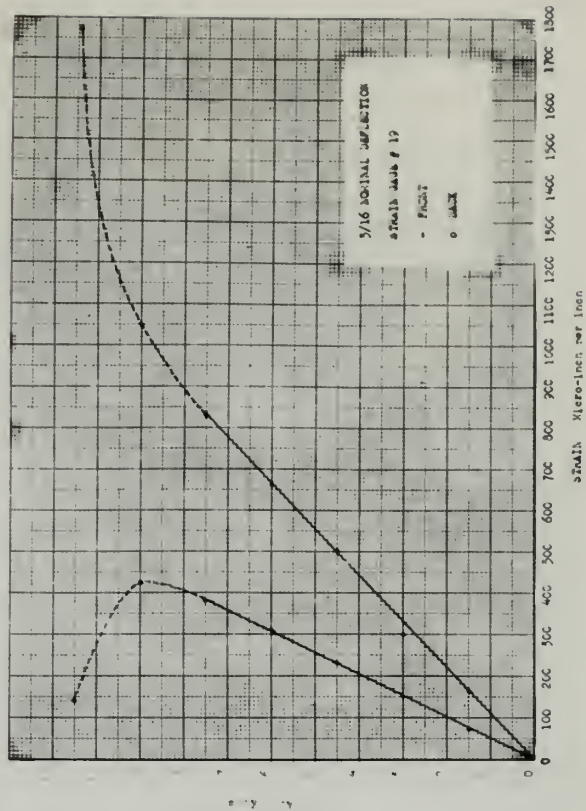
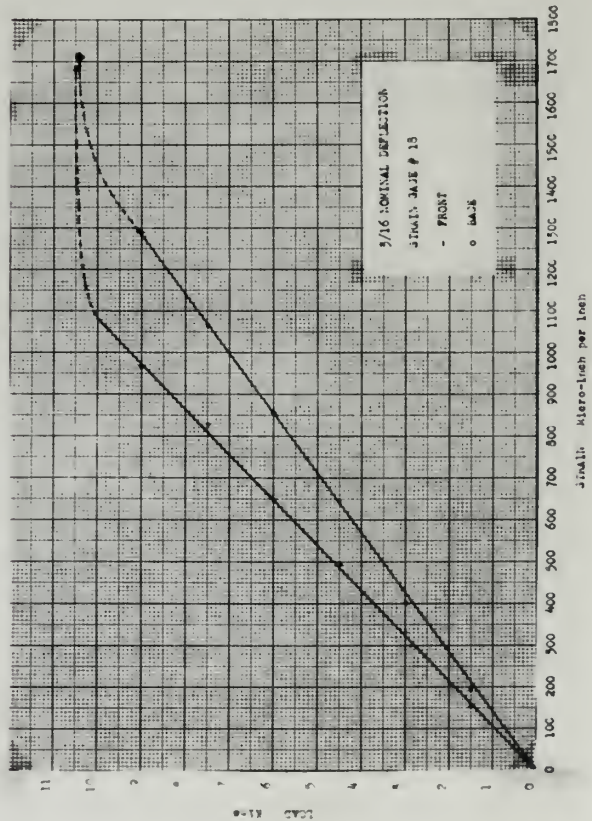
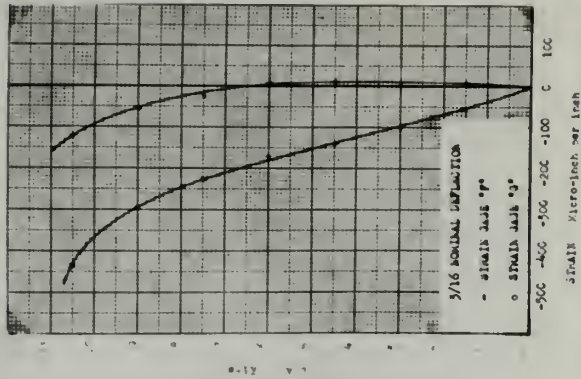
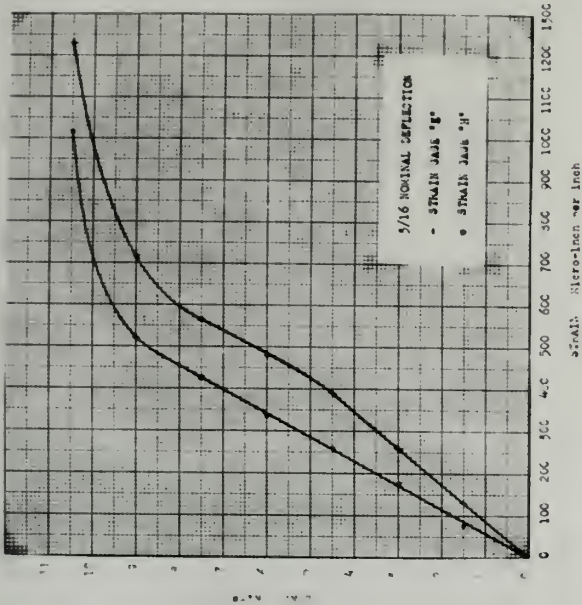
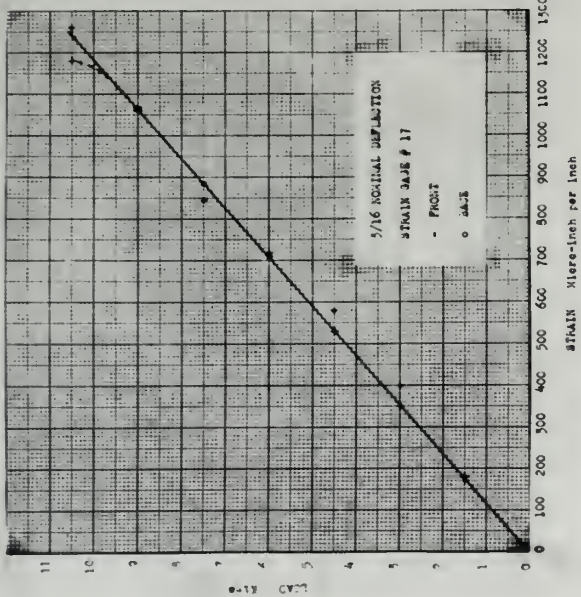


FIGURE XXXIV

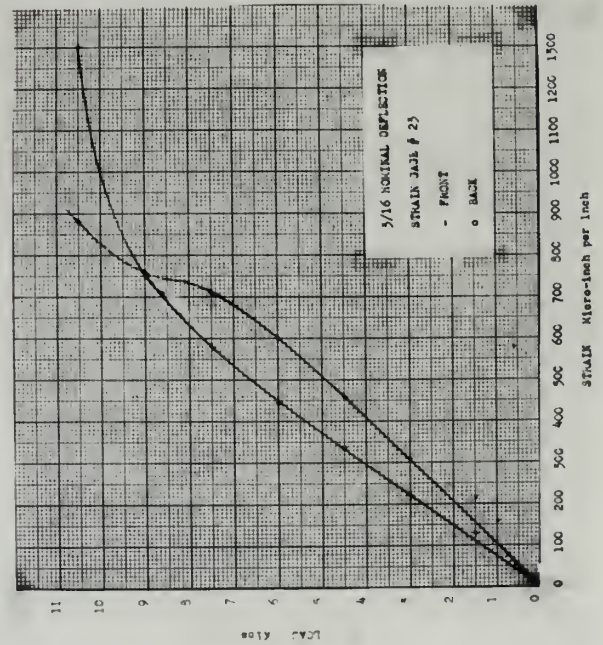
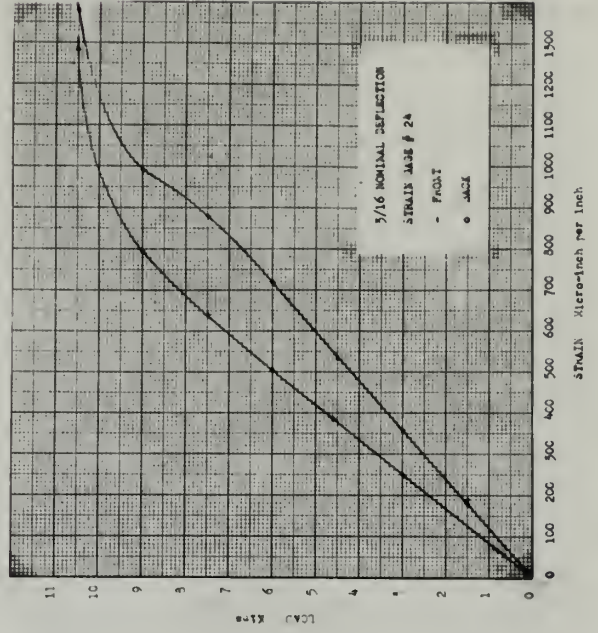
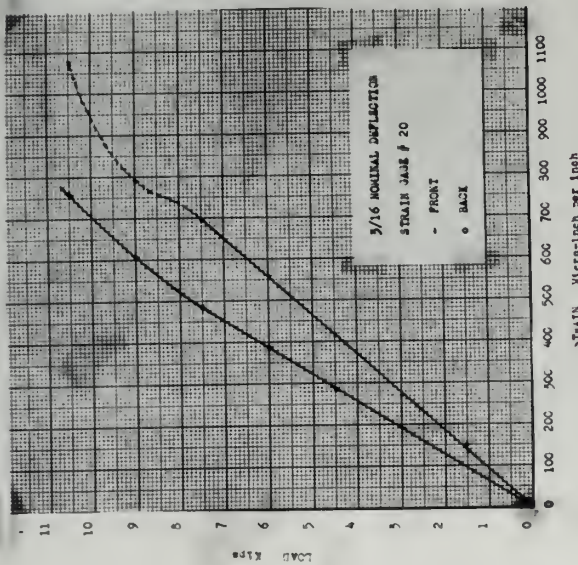
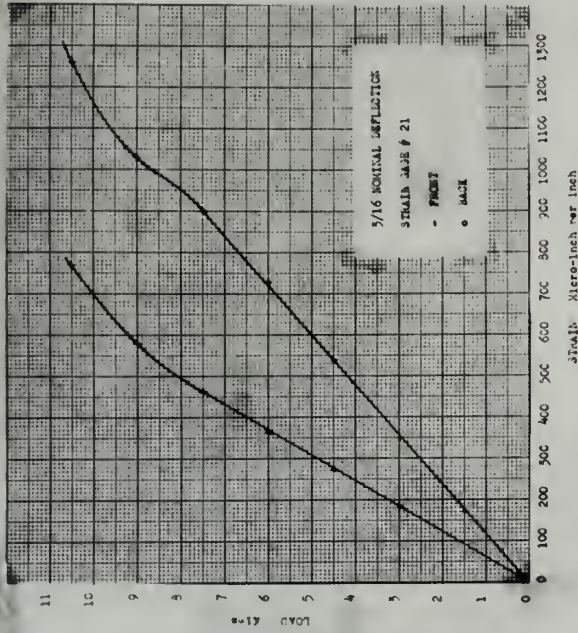
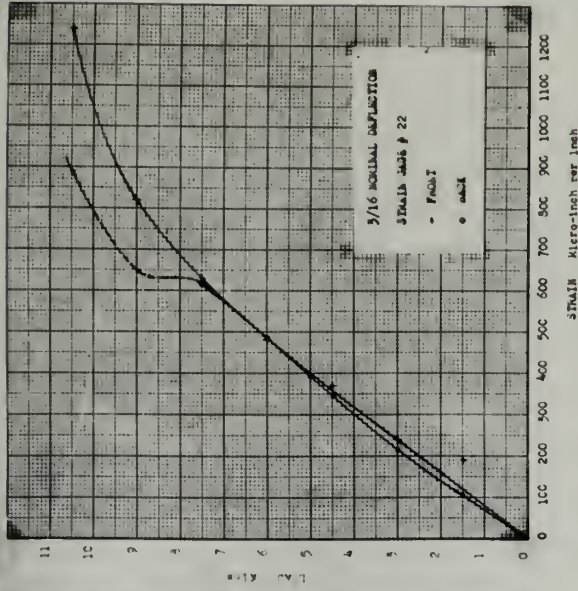


FIGURE XXXV

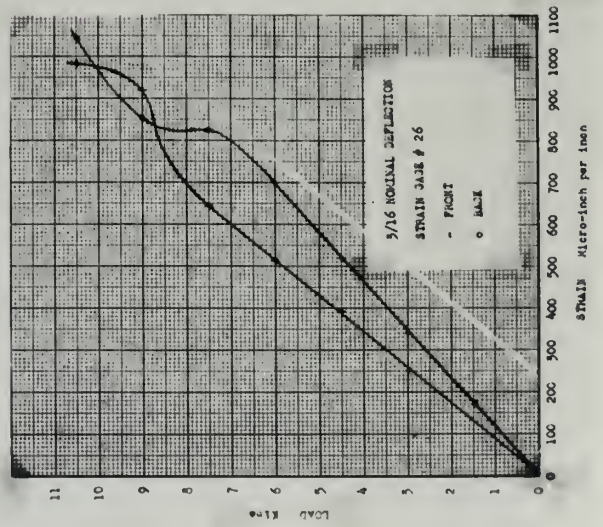
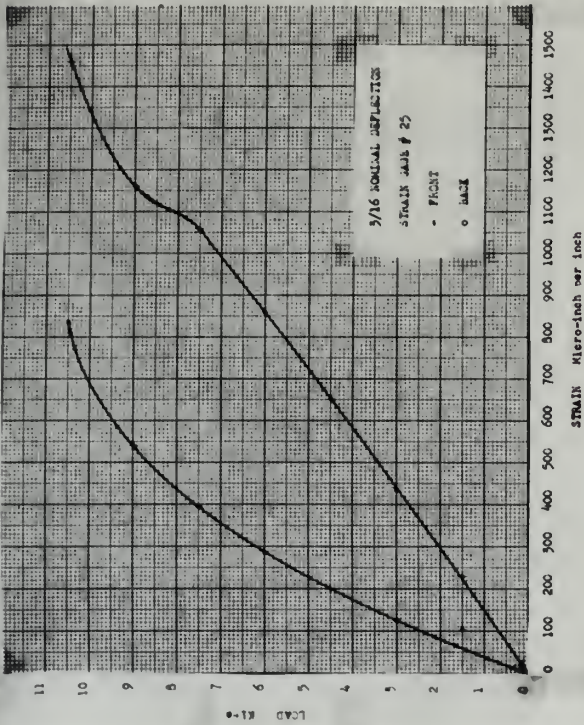
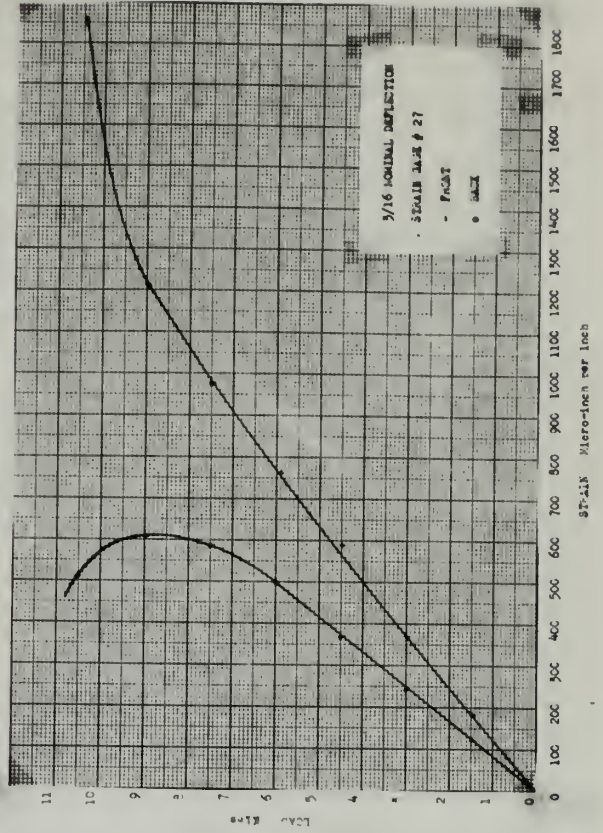
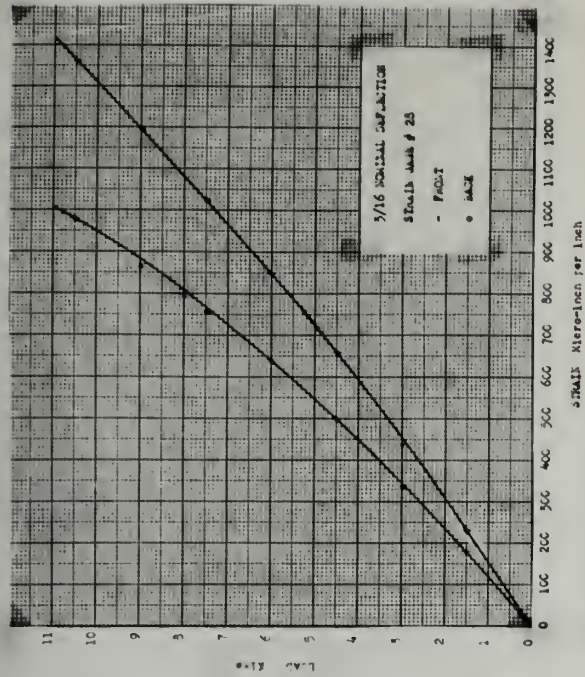


FIGURE XXXVI

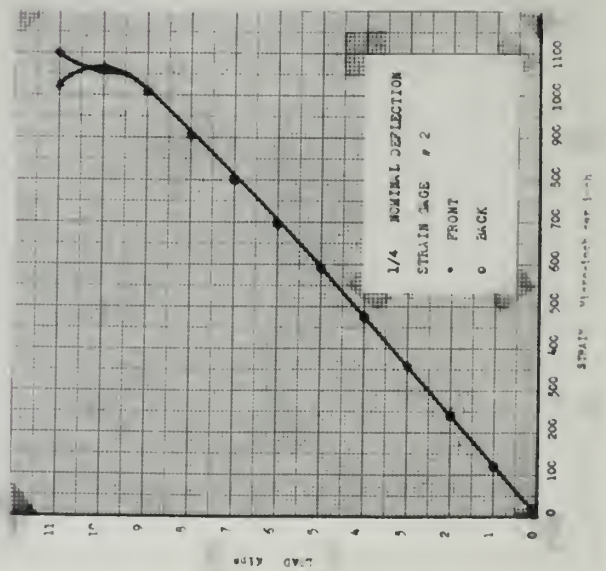
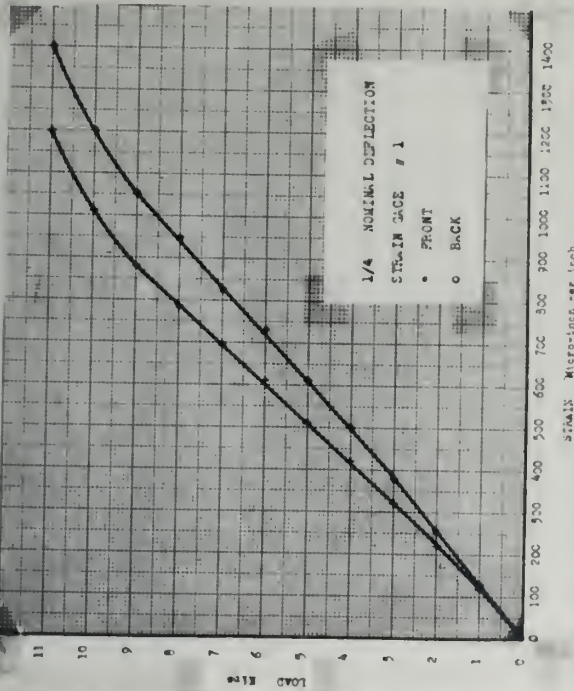
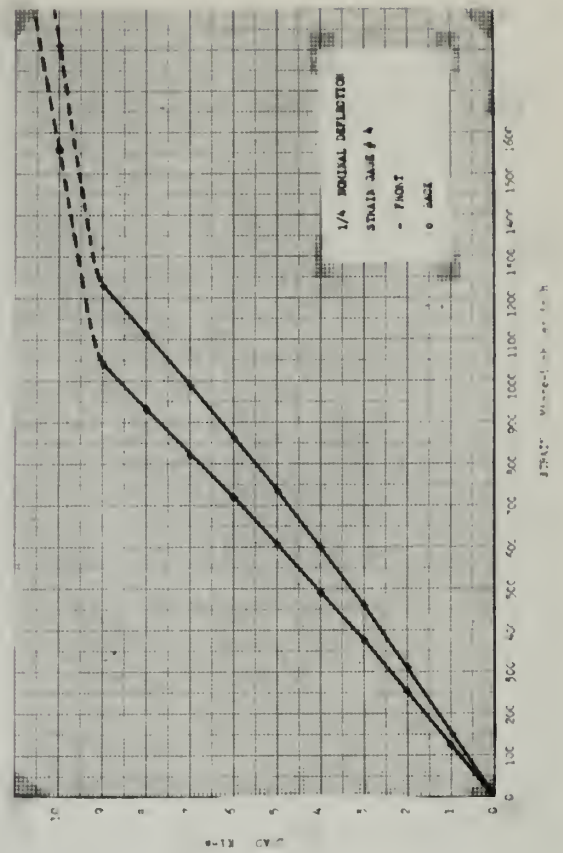
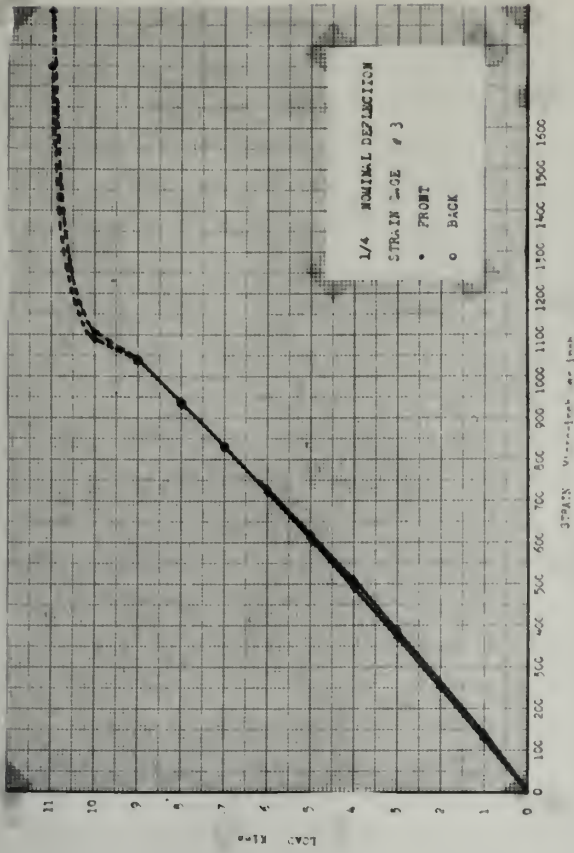
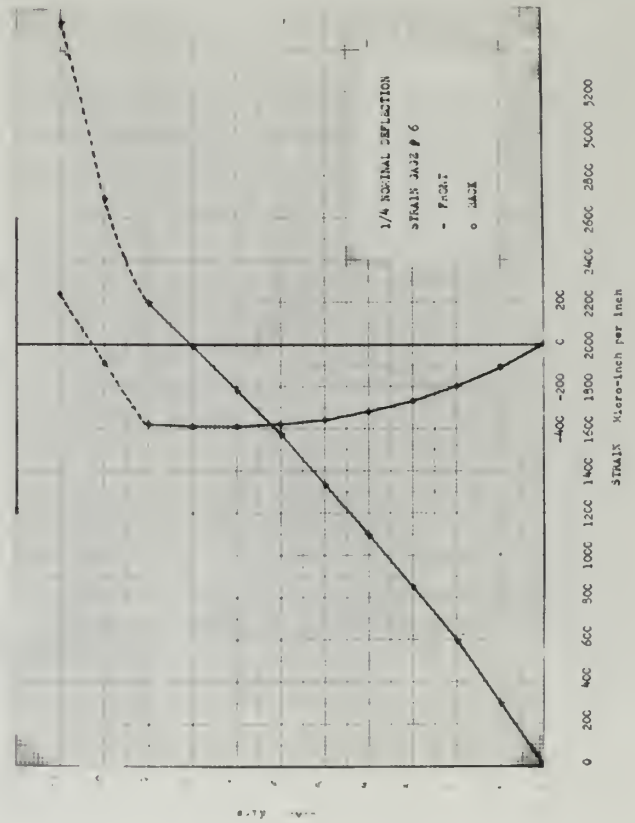
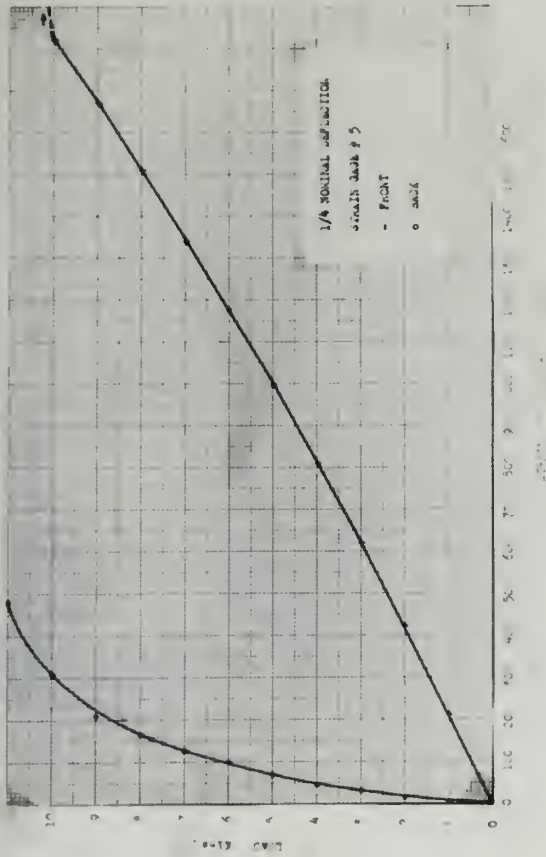
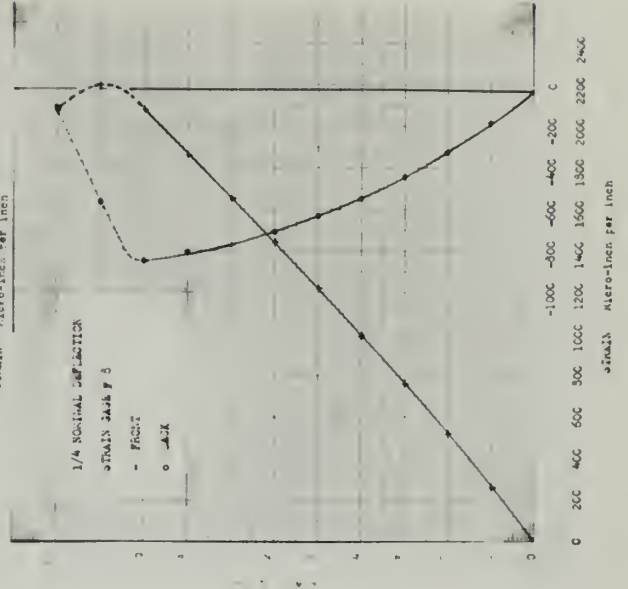
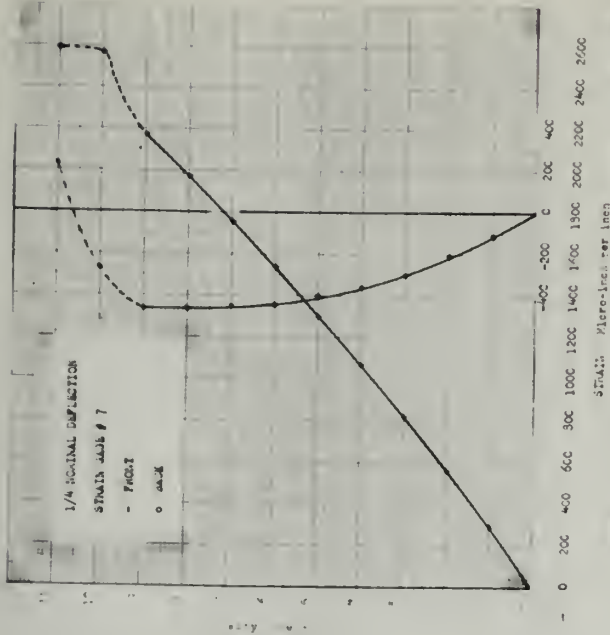


FIGURE XXXVII



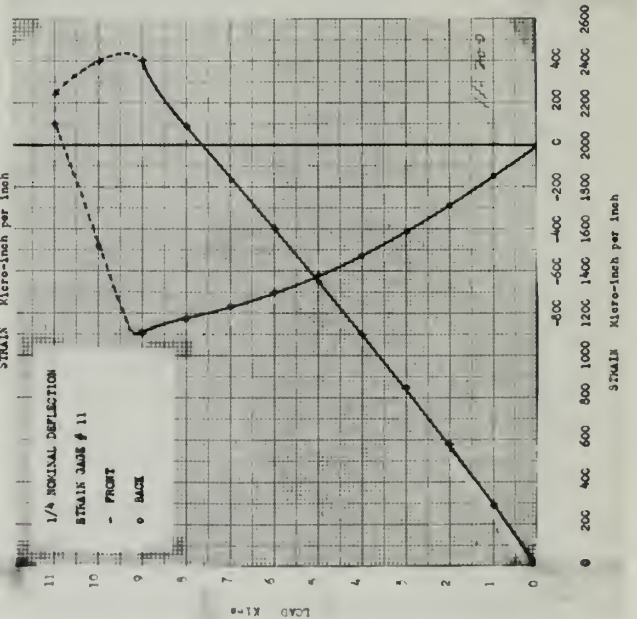
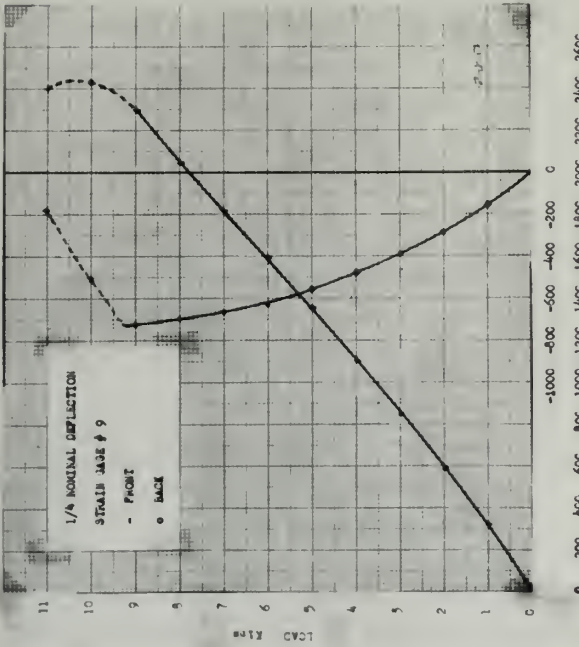
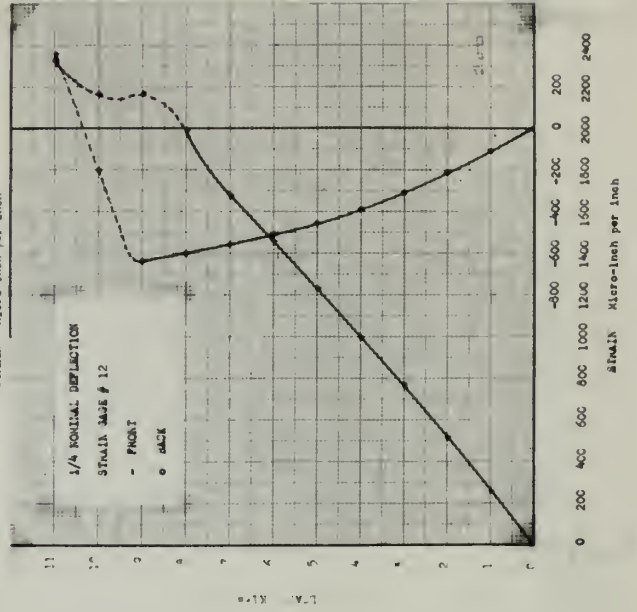
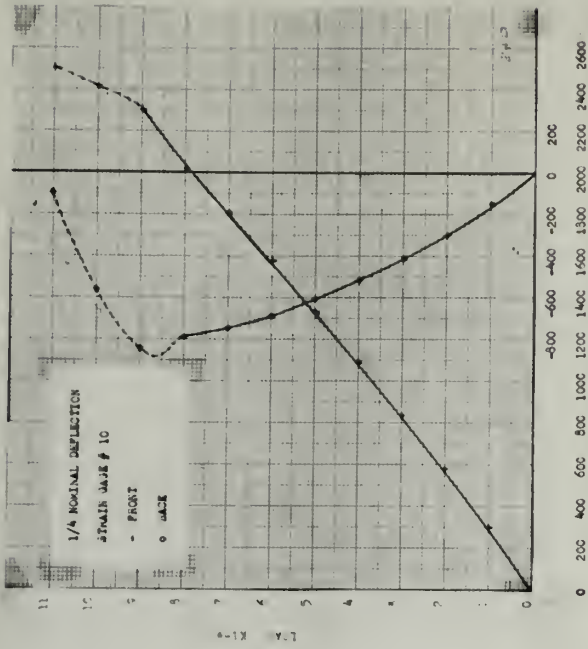


FIGURE XXXIX

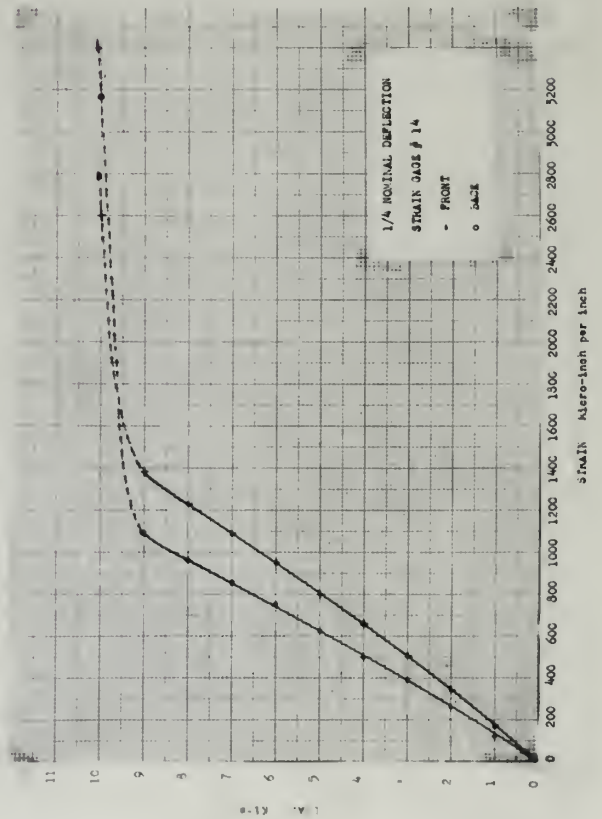
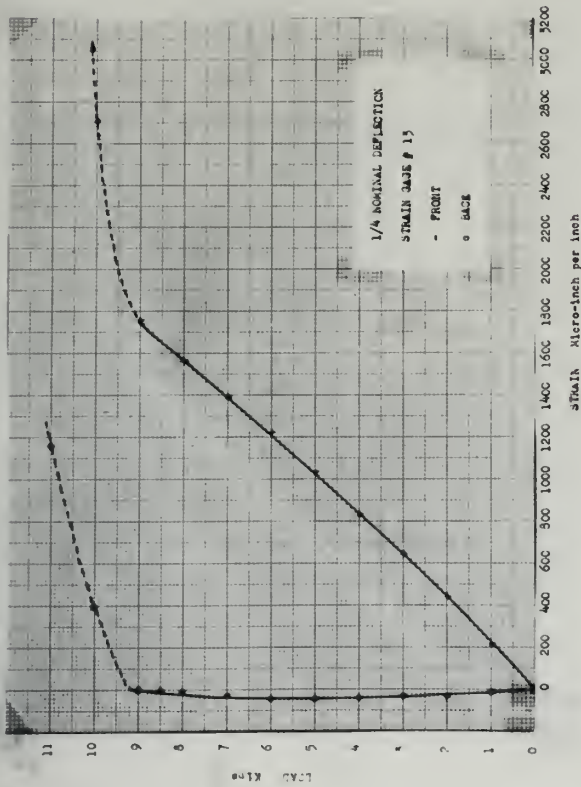
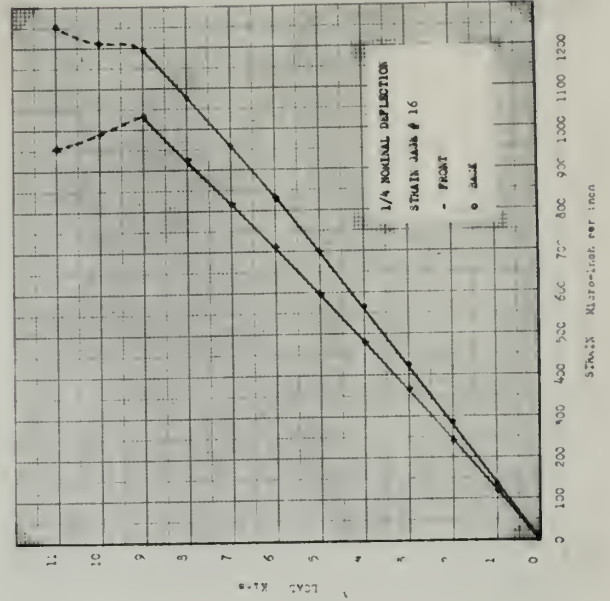
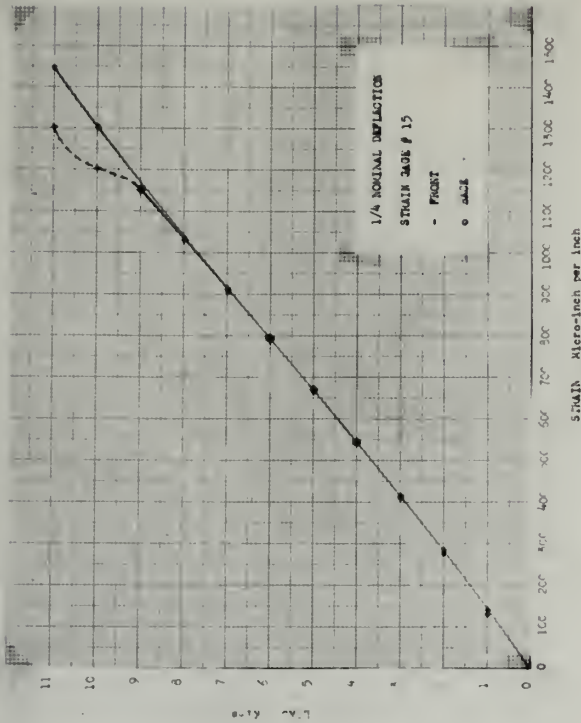


FIGURE XL

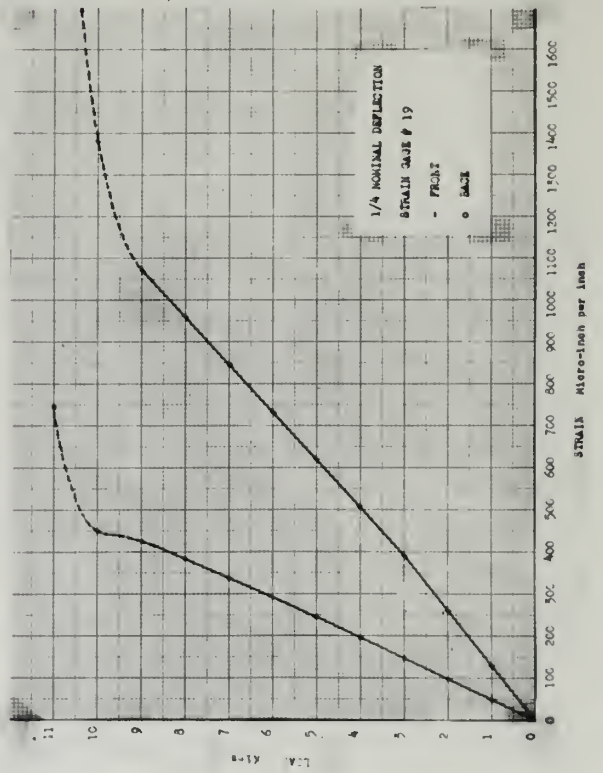
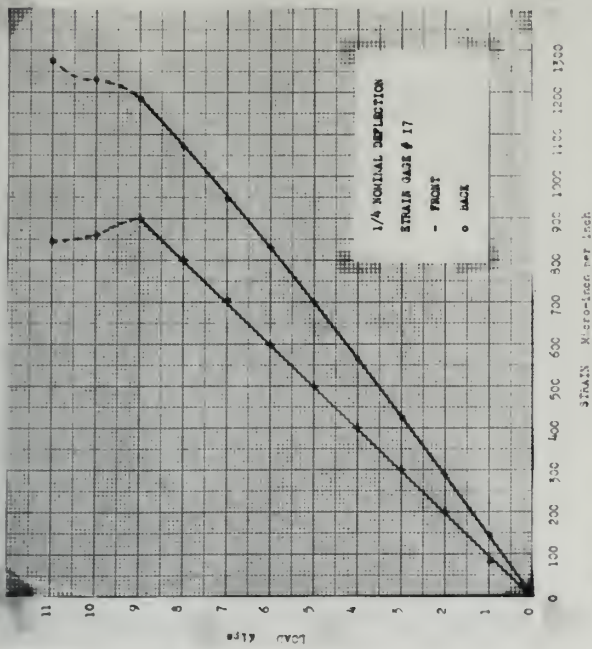
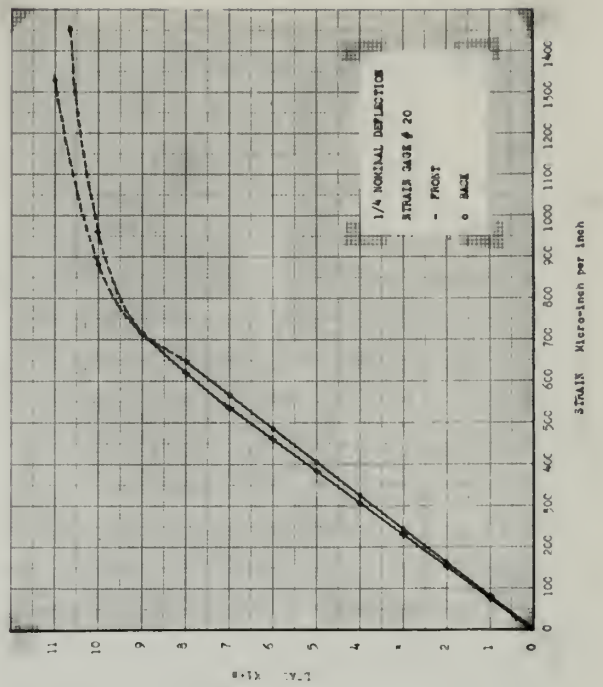
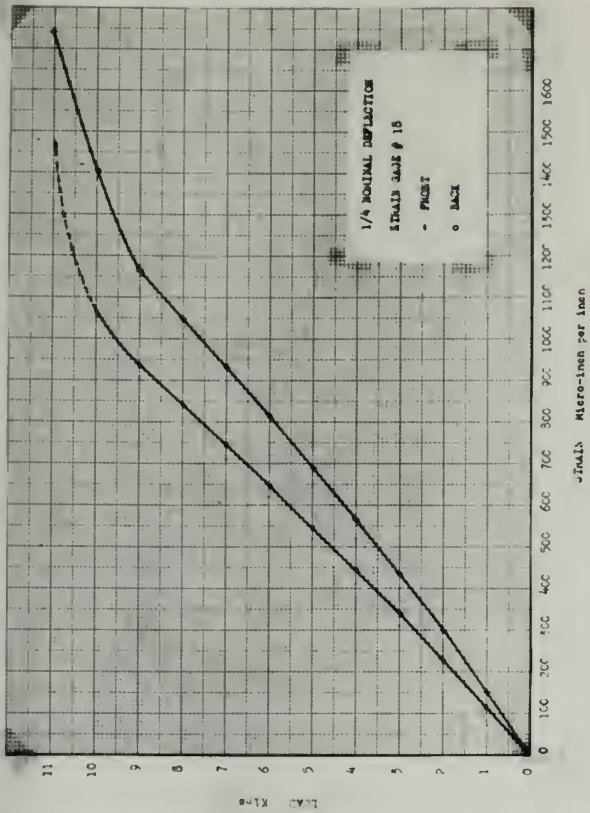


FIGURE XLI

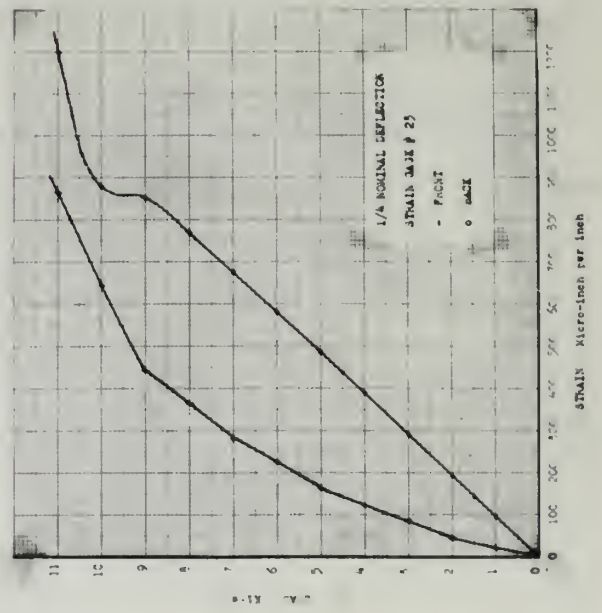
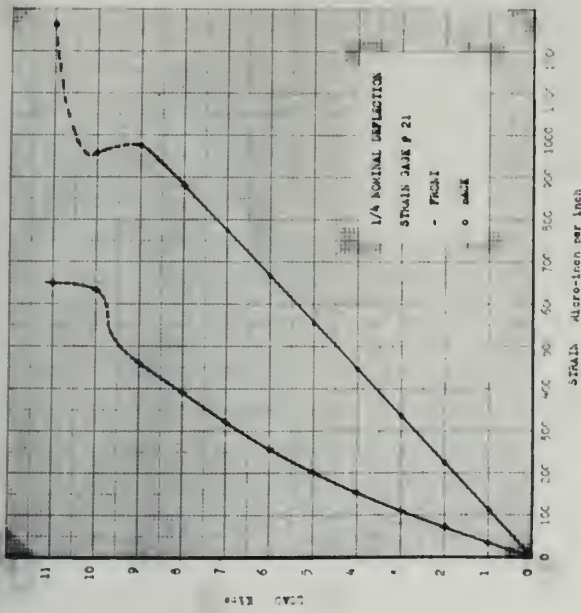
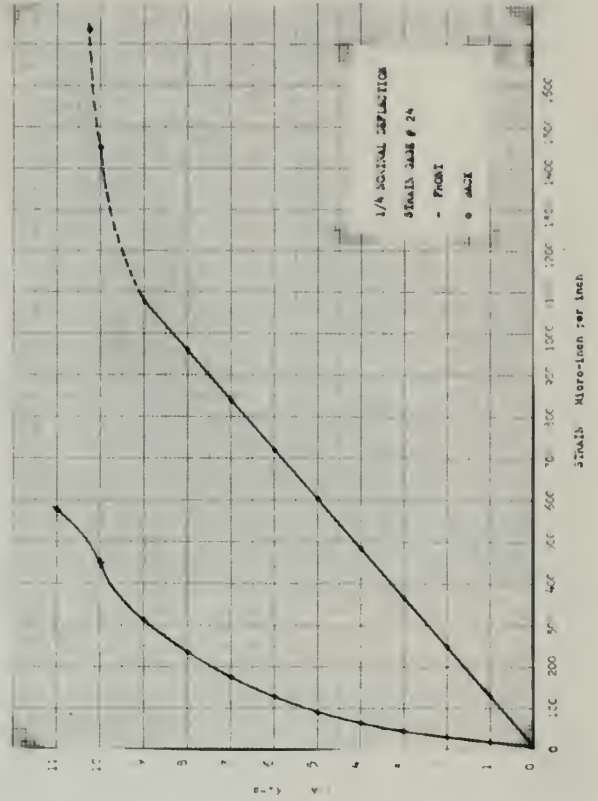
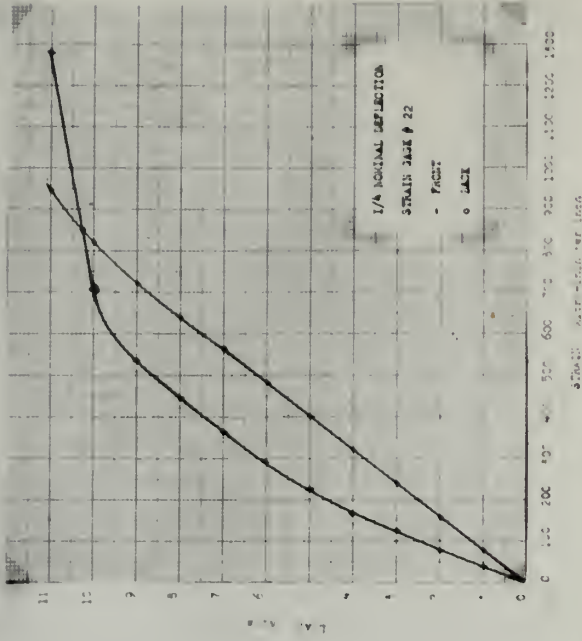


FIGURE XLII

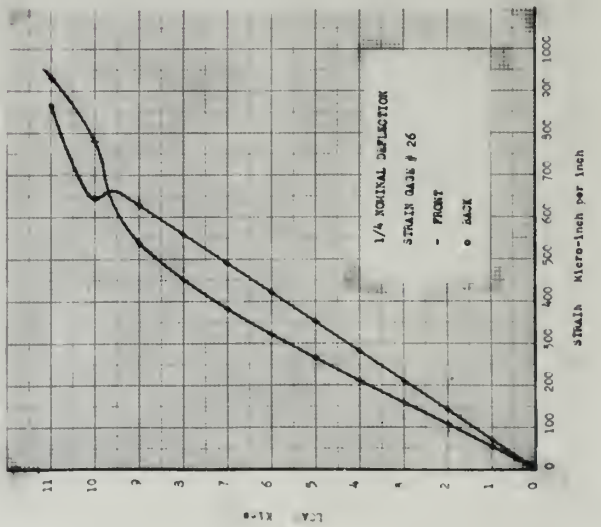
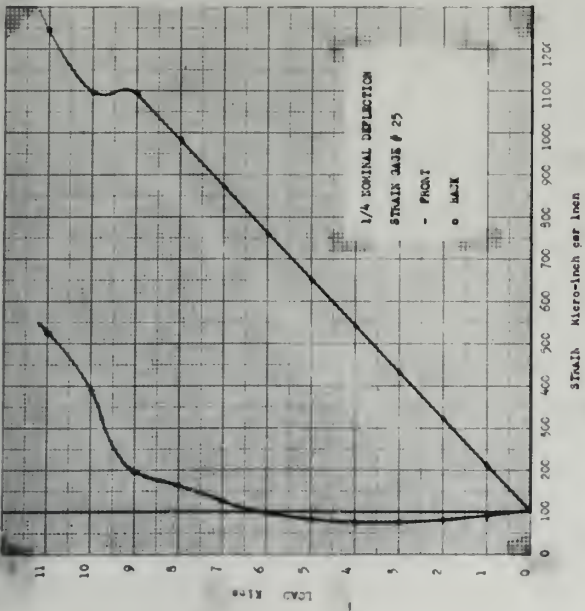
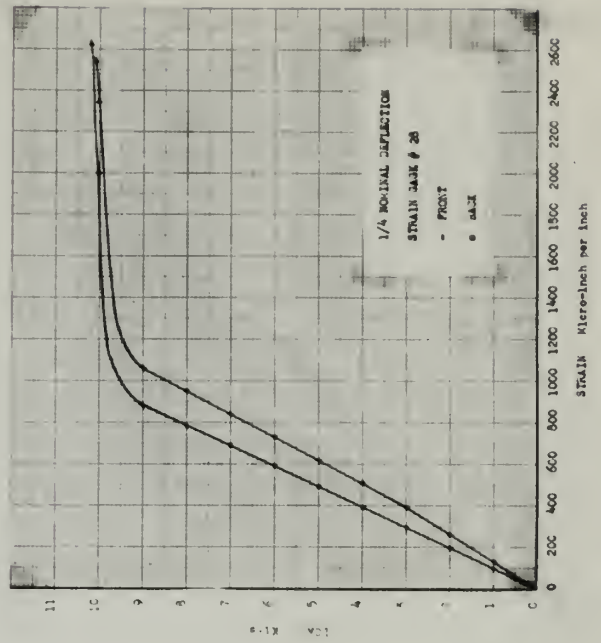
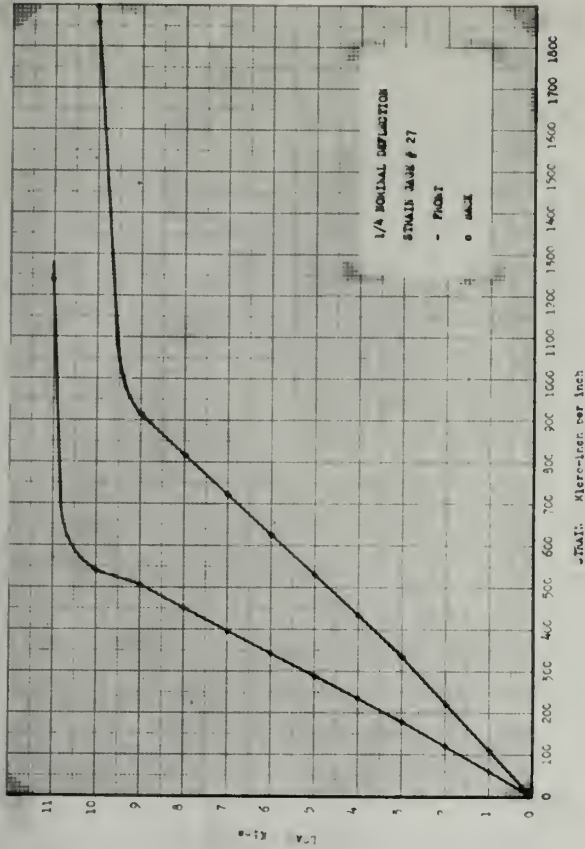
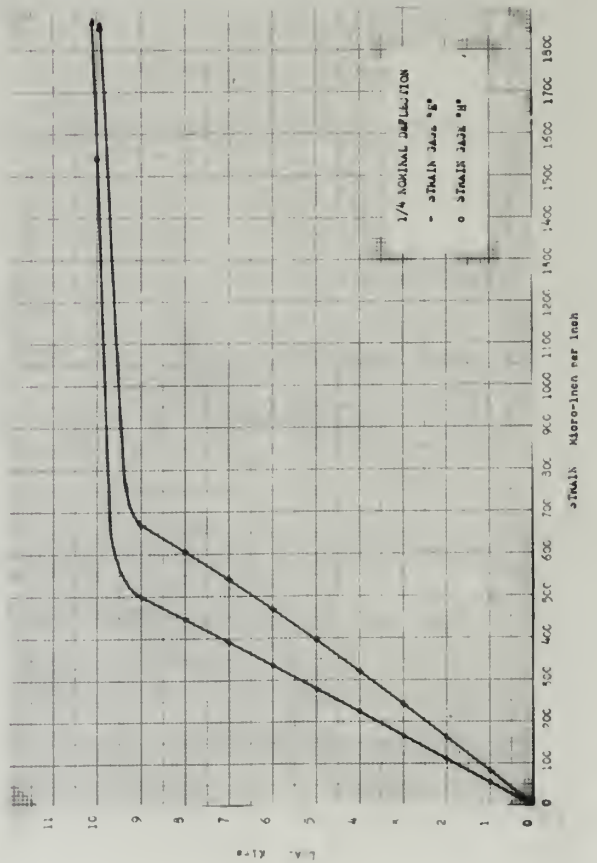
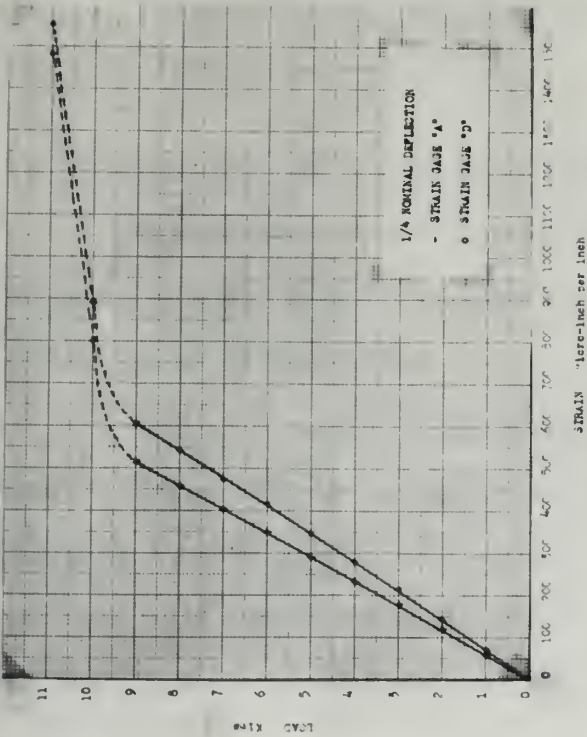
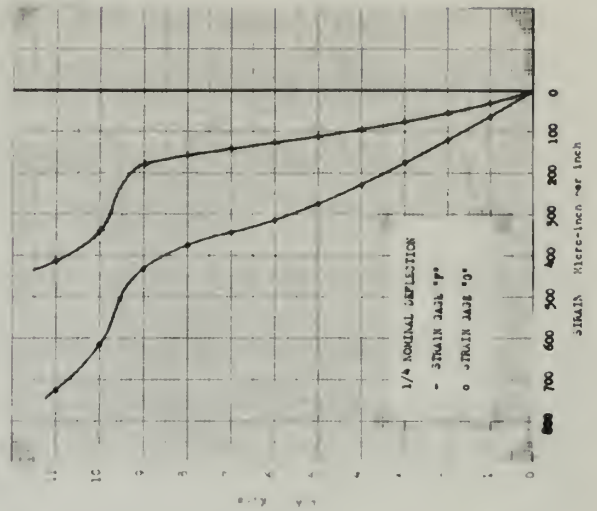
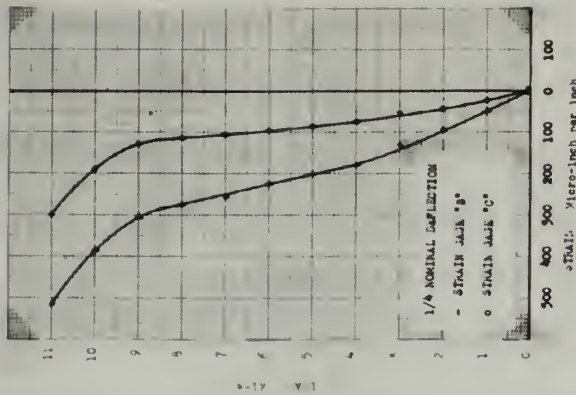


FIGURE XLIII



The maximum value of the strain in the front face at each level of load was obtained by taking the arithmetical mean of the strain values indicated by gages 7 front and 11 front.

The minimum value of the strain on the back face at each level of load was computed by taking the arithmetical mean average of the strain values of gages 8 back, 9 back, and 10 back.

The maximum value of the strain at the mid-depth of the plate at each level of load was calculated by taking the arithmetical mean average of the strain values of gages 4 front, 4 back, 14 front, and 14 back.

The ratios of maximum and minimum to average strain values were plotted against the ratios of average deflection (obtained as indicated in section 2.4) to plate thickness. These curves are shown in Figure LVII.

Table VII in the Appendix C contains the calculation of the values and ratios mentioned above.

2.11 Measured and Calculated Applied Load

The product of the average strain, the cross-sectional area of the plate, and the modulus of elasticity equals the magnitude of the load supported by the plate.

From the curves of the strain distribution in the stiffeners, shown in Figure LVI, the arithmetical mean average strain in the two stiffeners of each plate was obtained. Multiplying this value by the product of the cross-sectional area of the stiffeners and the modulus of elasticity gives the magnitude of the load supported by the stiffeners.

The maximum value of the strain in the front face of each level of load was obtained by taking the arithmetical mean of the strain values indicated by gages 7 front and 11 front.

The strain value of the strain on the back face at each level of load was computed by taking the arithmetical mean average of the strain values of gages 8 back, 9 back, and 10 back.

The maximum value of the strain at the mid-depth of the plate at each level of load was calculated by taking the arithmetical mean average of the strain values of gages 4 front, 14 front, and 14 back.

The ratios of maximum and minimum to average strain values were plotted against the ratios of average deflection (obtained as indicated in section 2.4) to plate thickness. These curves are shown in Figure

LVII.

Table VII in the Appendix 5 contains the calculation of the values and ratios mentioned above.

2.11 Measured and Calculated Applied Load

The product of the average strain, the cross-sectional area of the plate, and the modulus of elasticity equals the magnitude of the load supported by the plate.

From the curves of the strain distribution in the stiffeners, shown in Figure XVI, the arithmetical mean average strain in the two stiffeners of each plate was obtained. Multiplying this value by the product of the cross-sectional area of the stiffeners and the modulus of elasticity gives the magnitude of the load supported by the stiffeners.

The sum of the load on the plate and the load on the stiffeners should be equal to the applied load. This comparison was made for a load of 60,000 pounds, assuming a modulus of elasticity of the material of 29,000,000 pounds per square inch, and the difference between the applied load and the calculated load was

- 800 pounds or -1.33% for the plate of zero nominal deflection
- 5400 pounds or 9 % for the plate of 1/8" nominal deflection
- 4000 pounds or 6.7 % for the plate of 3/16" nominal deflection
- 1100 pounds or -1.8 % for the plate of 1/4" nominal deflection.

The differences were considered small and within the accuracy of the measurements. The calculation is shown in Appendix D.

The results of the tests are given in the following table. The values in parentheses are the standard deviations of the measurements. The values in brackets are the values of the standard deviations of the measurements of the angles of the deflection of the beam.

III RESULTS

The results of this investigation are shown in Figures XLIV through LVII.

FIGURE XLIV

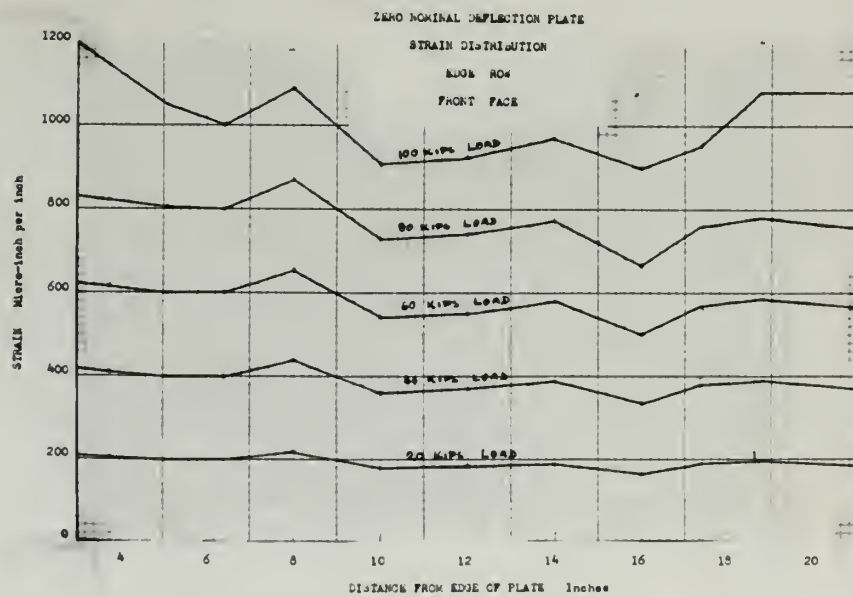
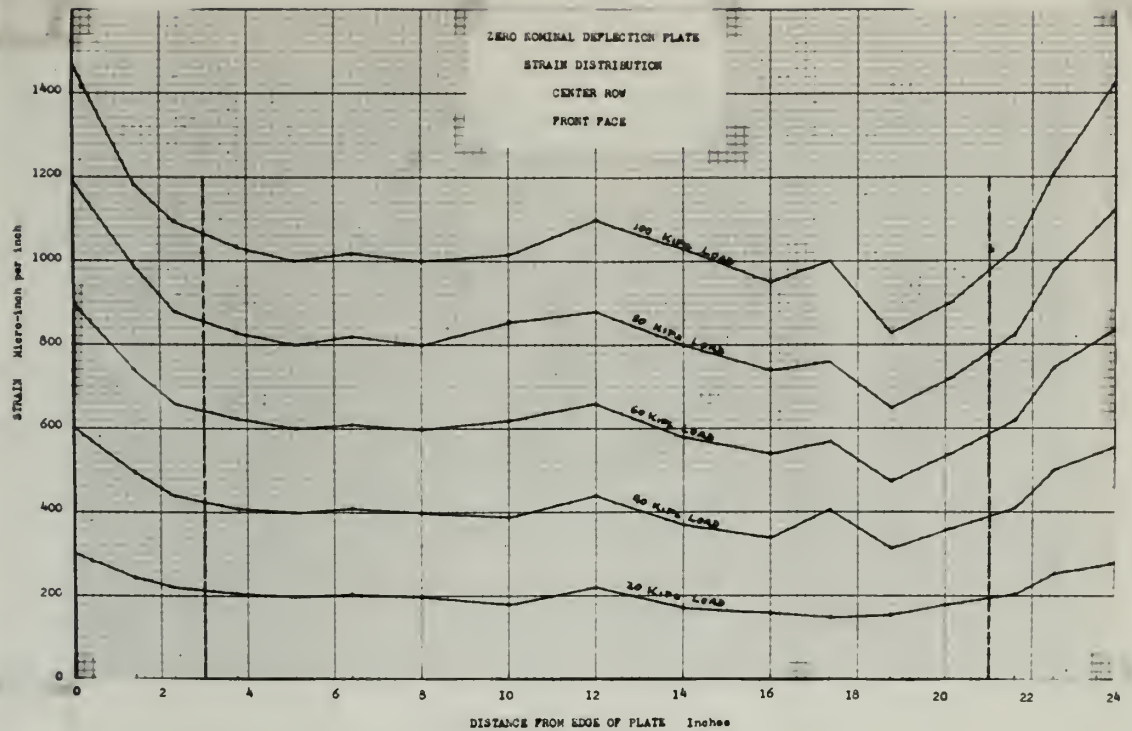


FIGURE XLV

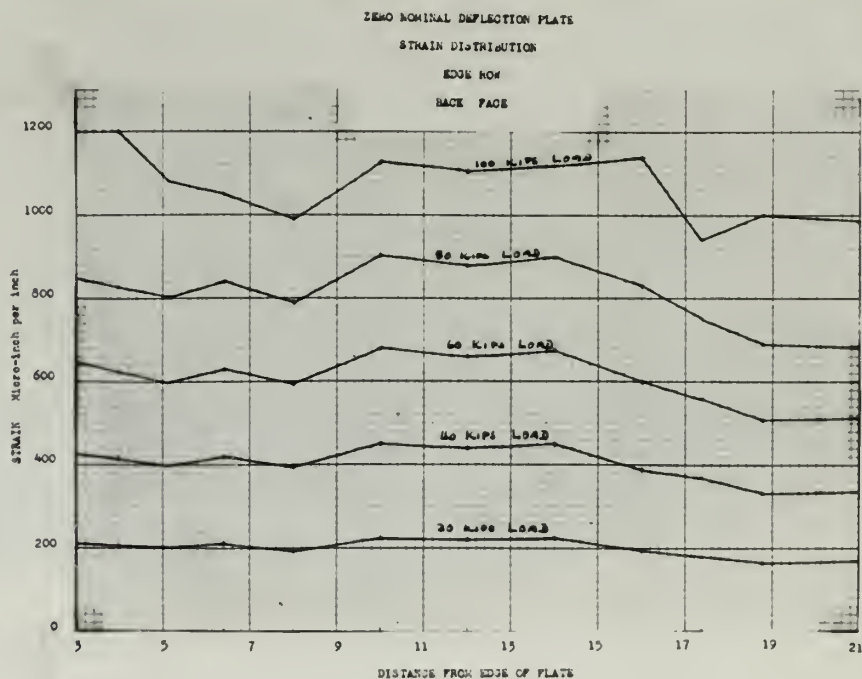
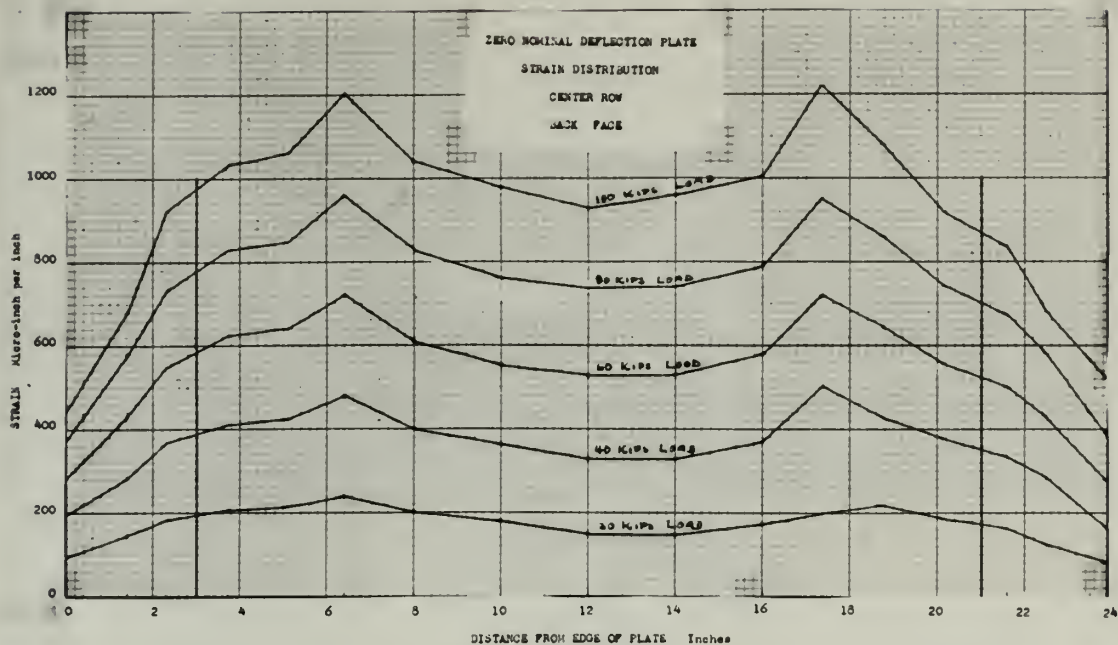


FIGURE XLVI

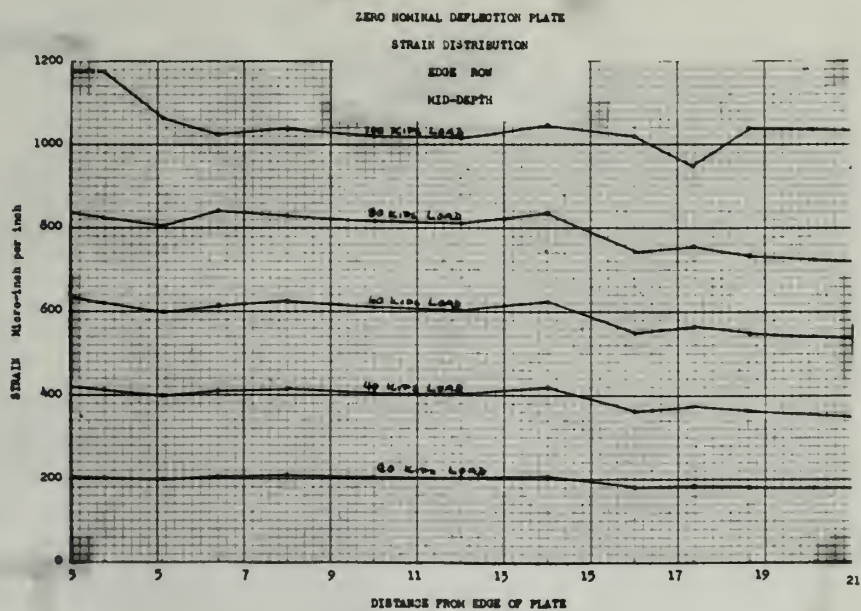
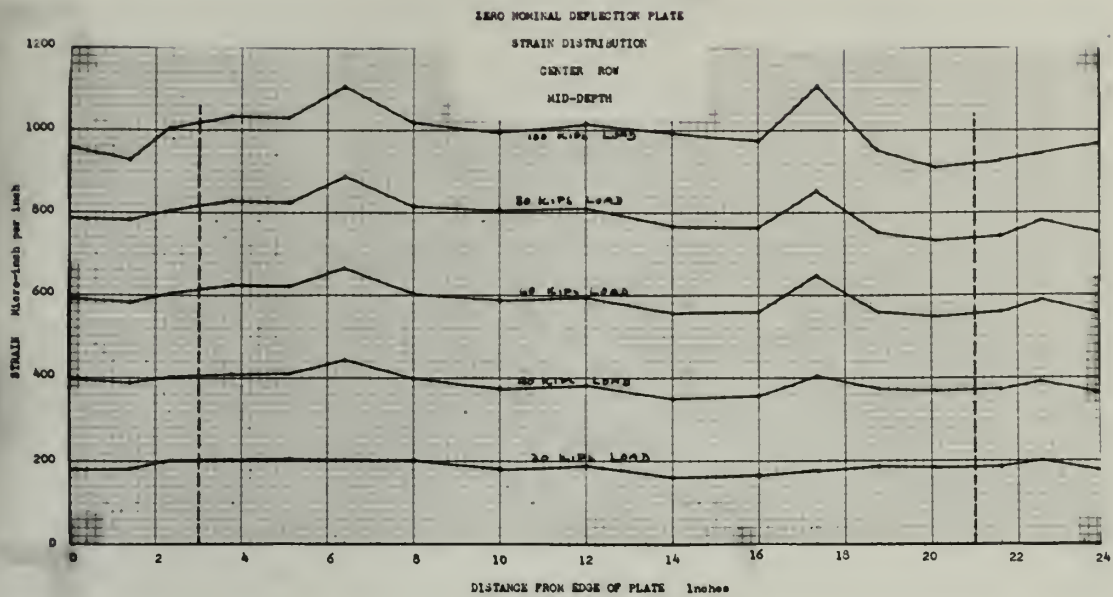


FIGURE XLVII

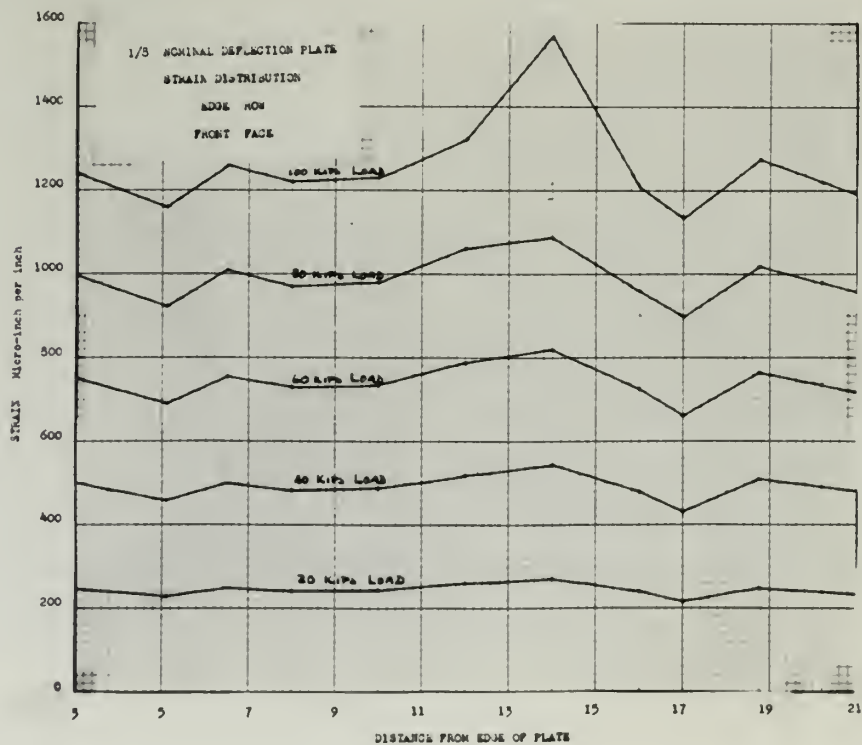
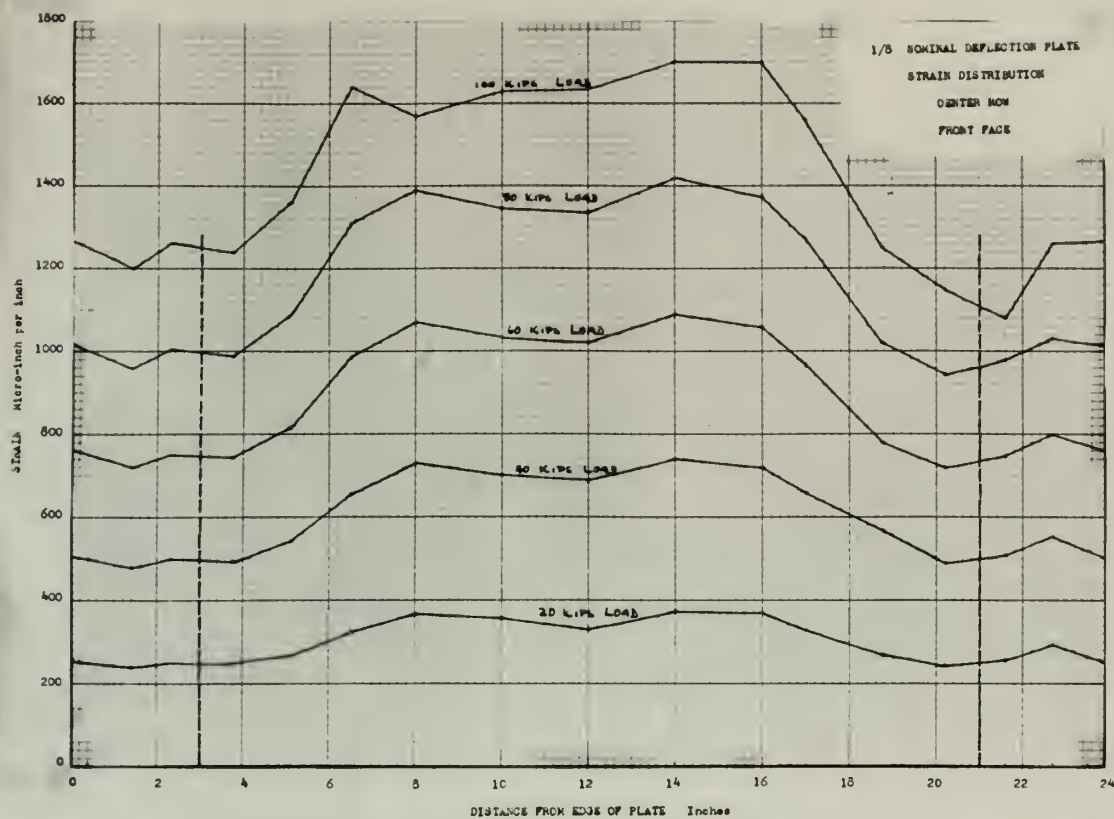


FIGURE XLVIII

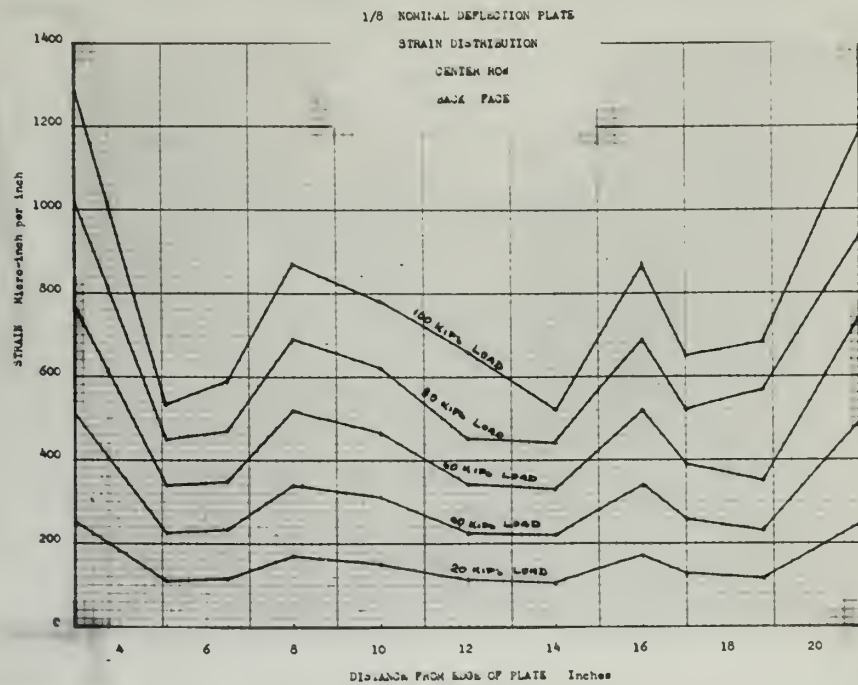
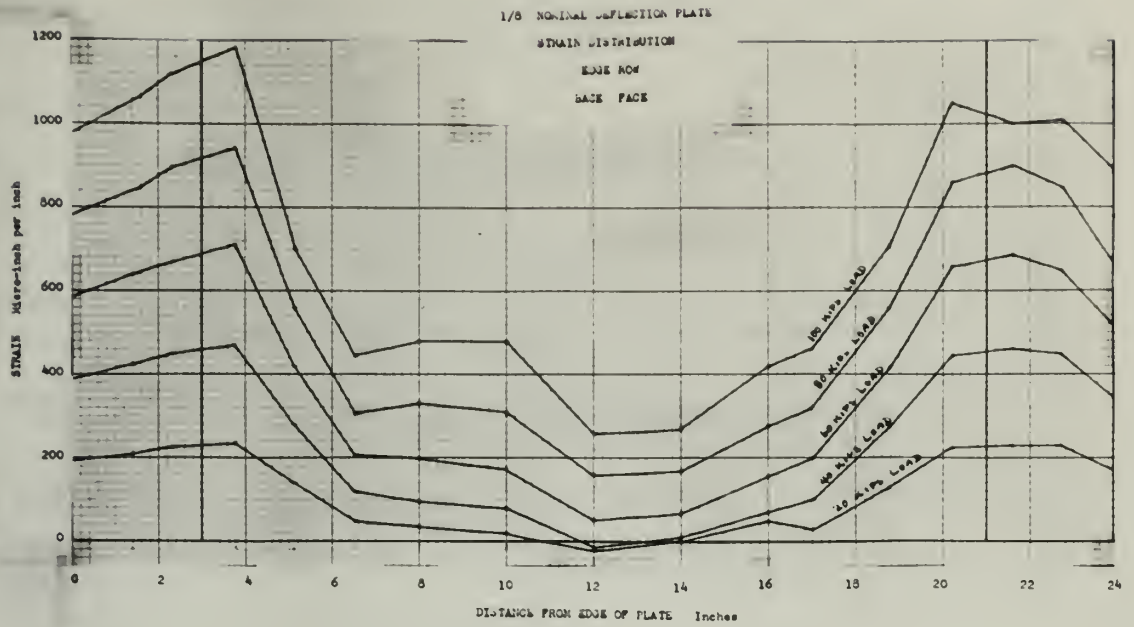


FIGURE XLIX

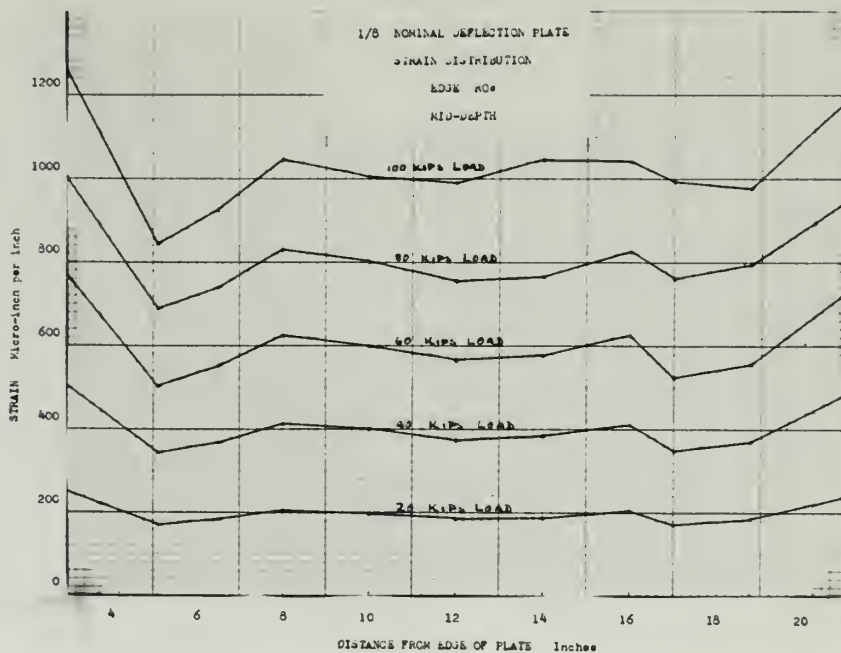
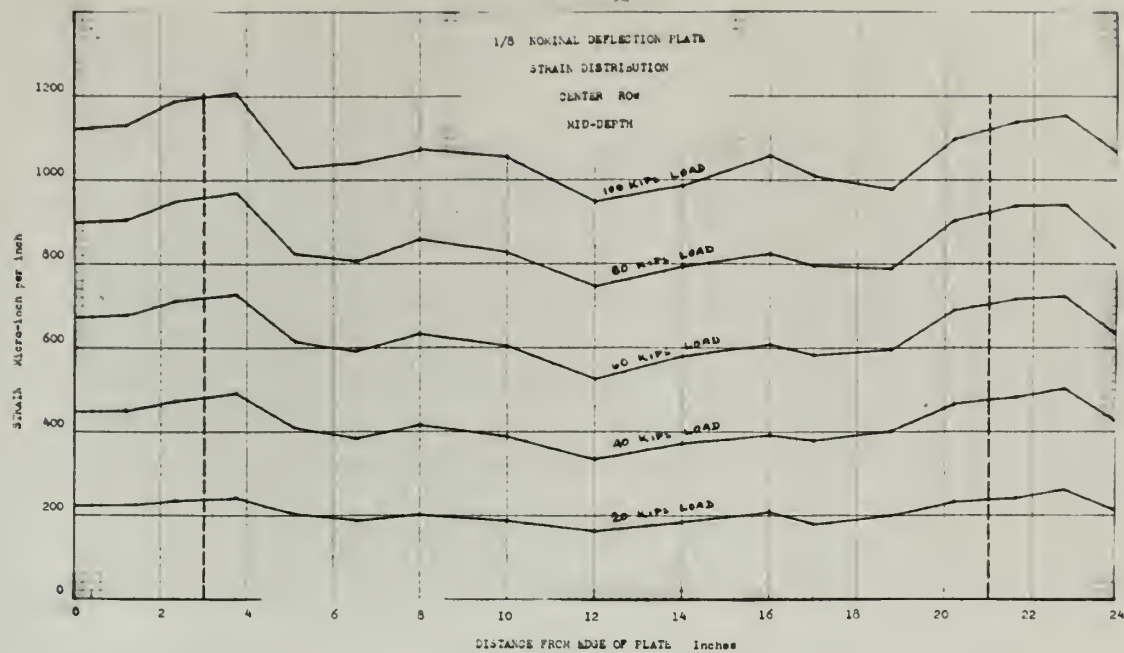


FIGURE L

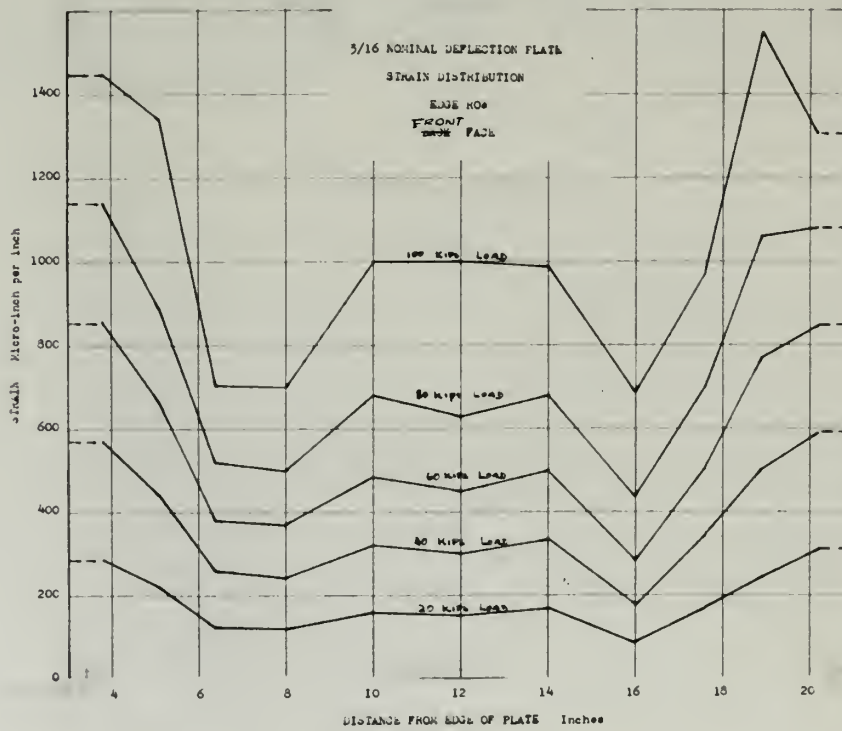
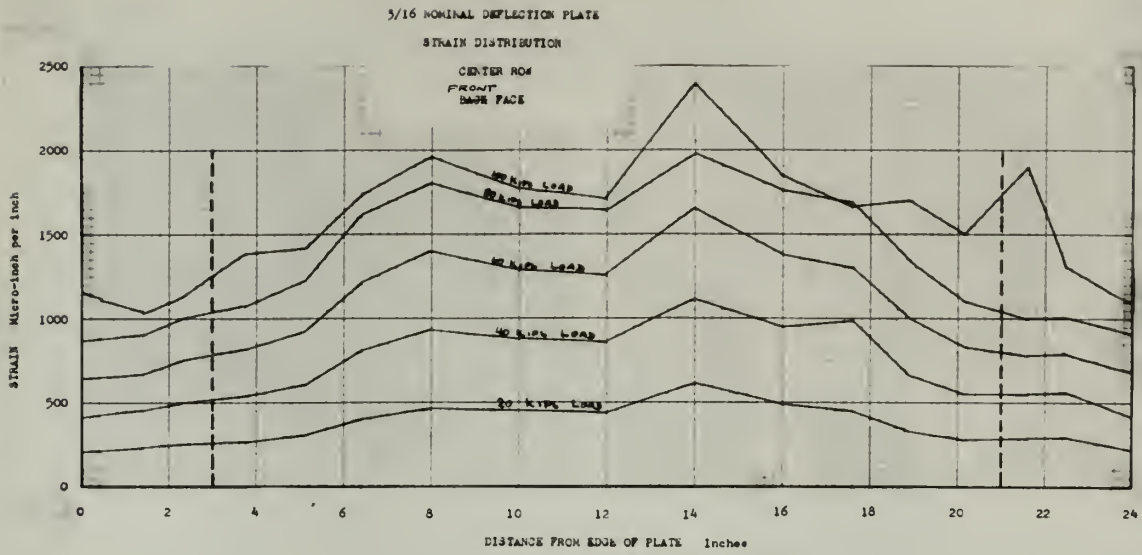


FIGURE LI

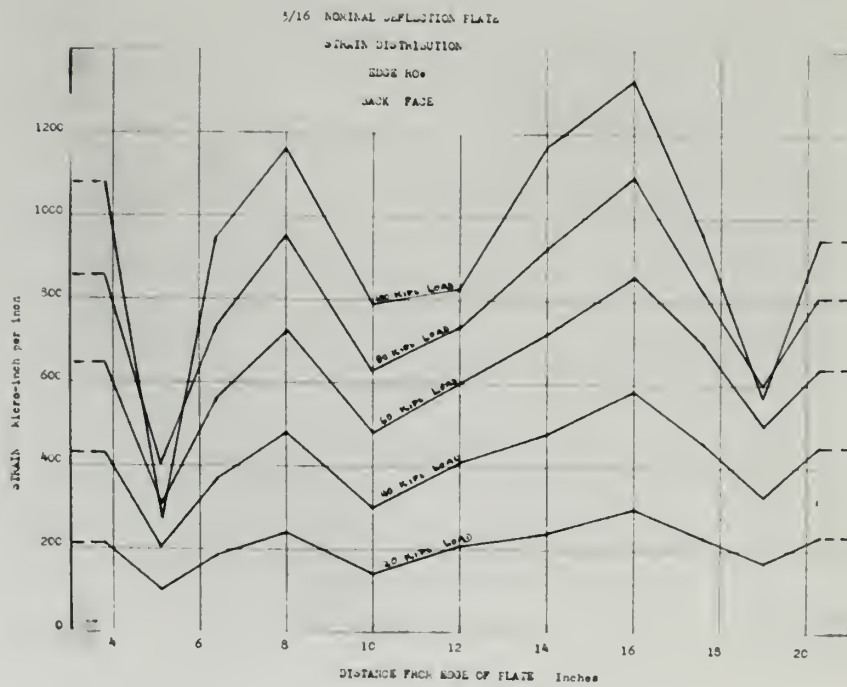
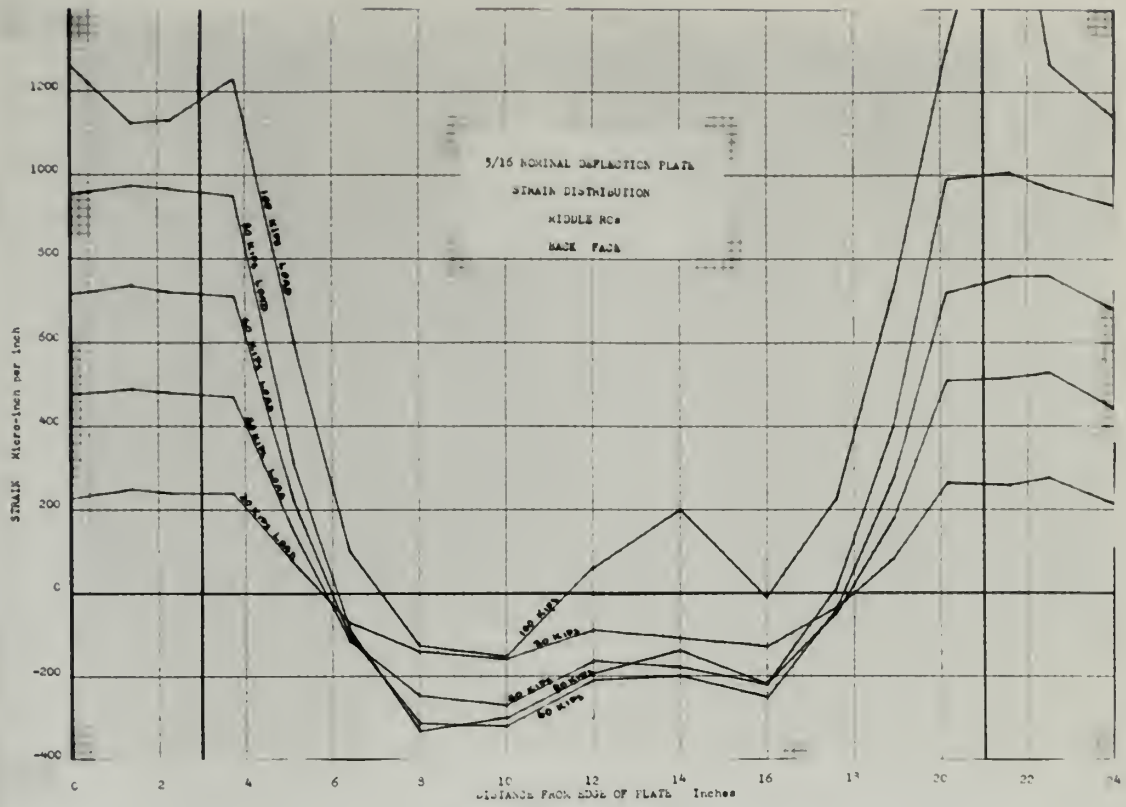


FIGURE LII

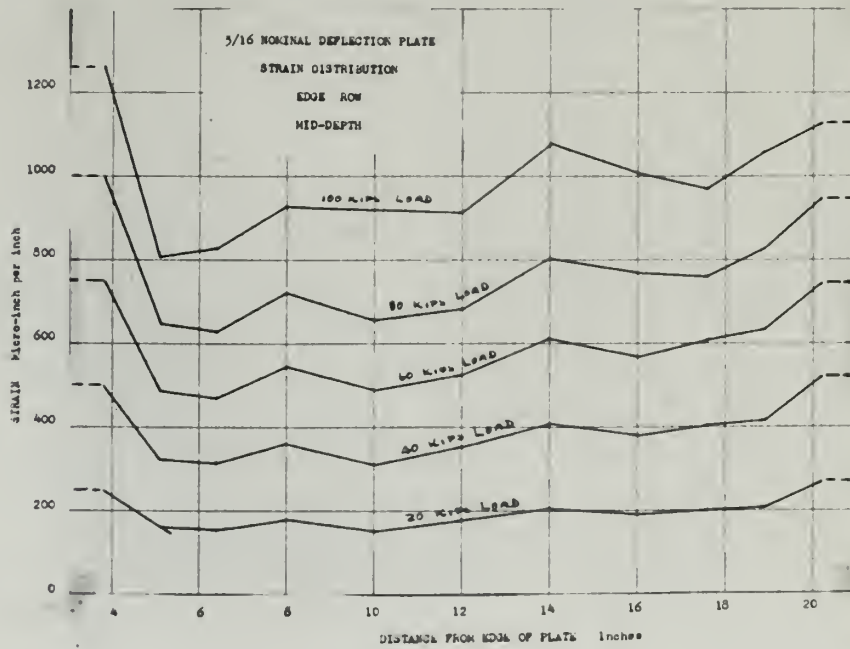
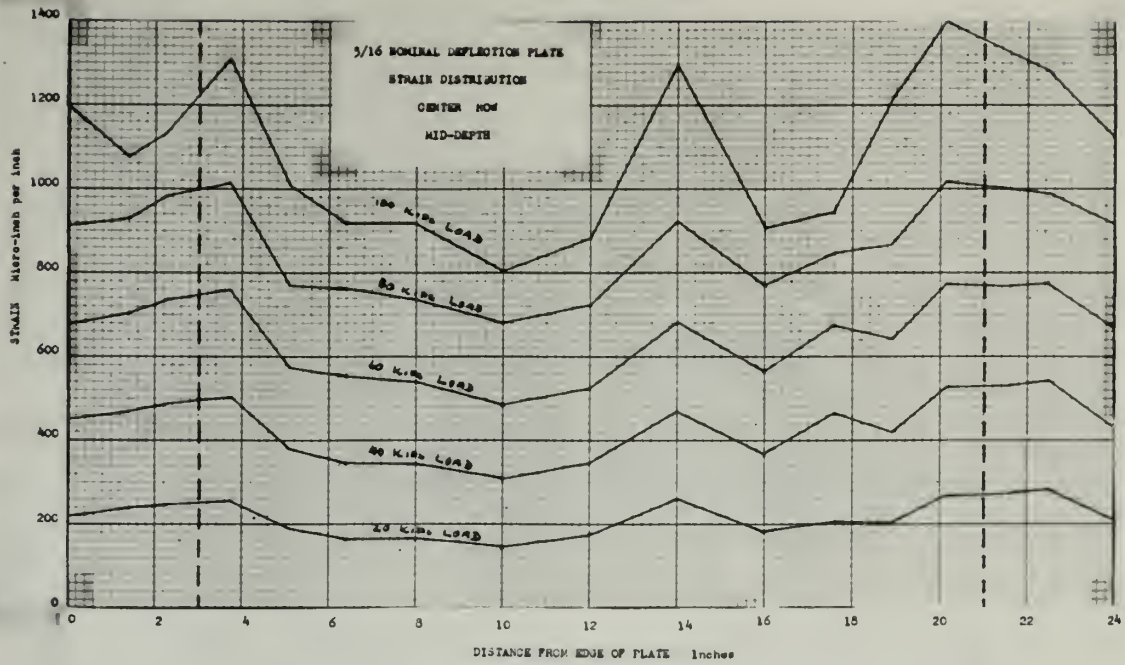


FIGURE LIII

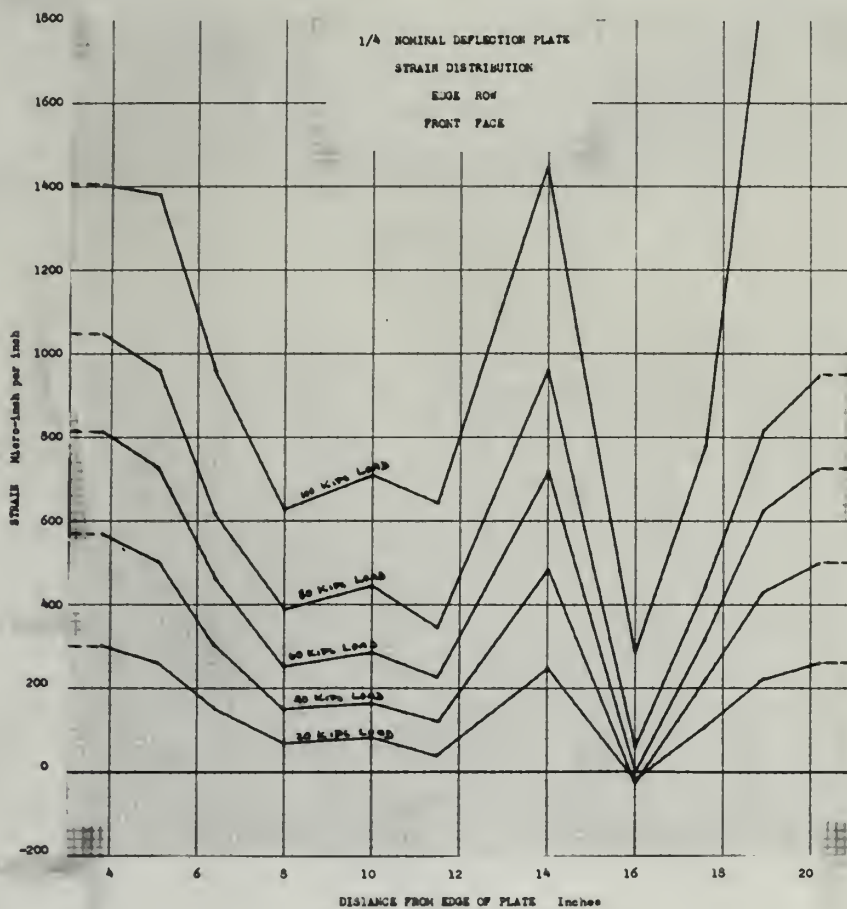
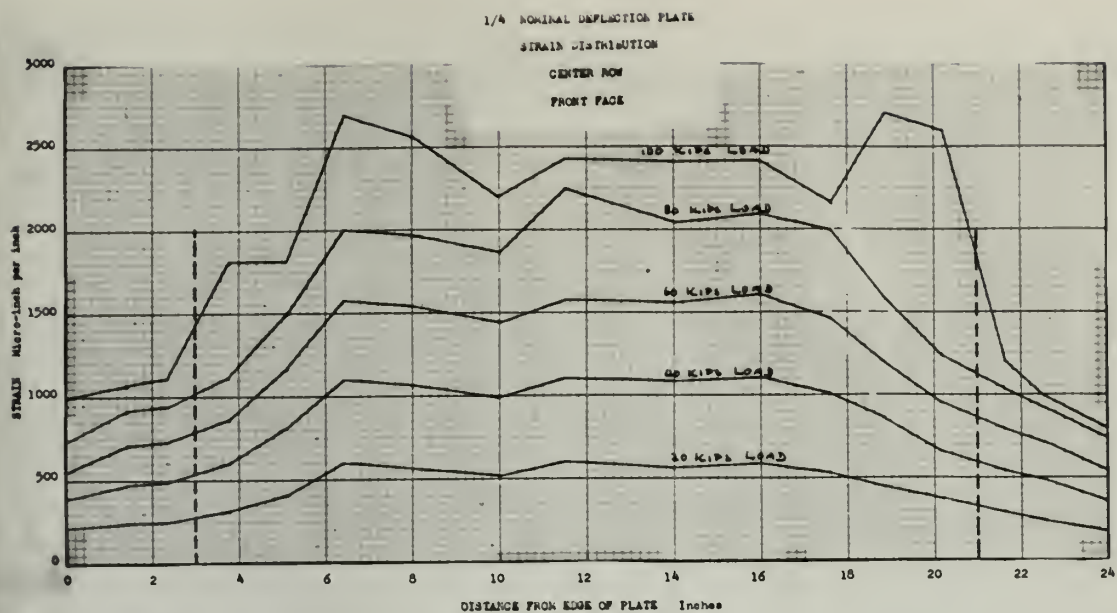


FIGURE LIV

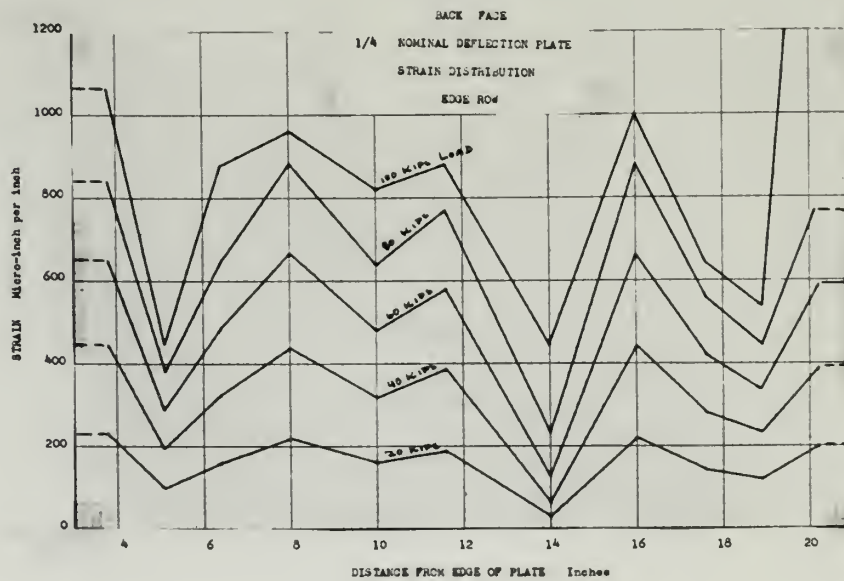
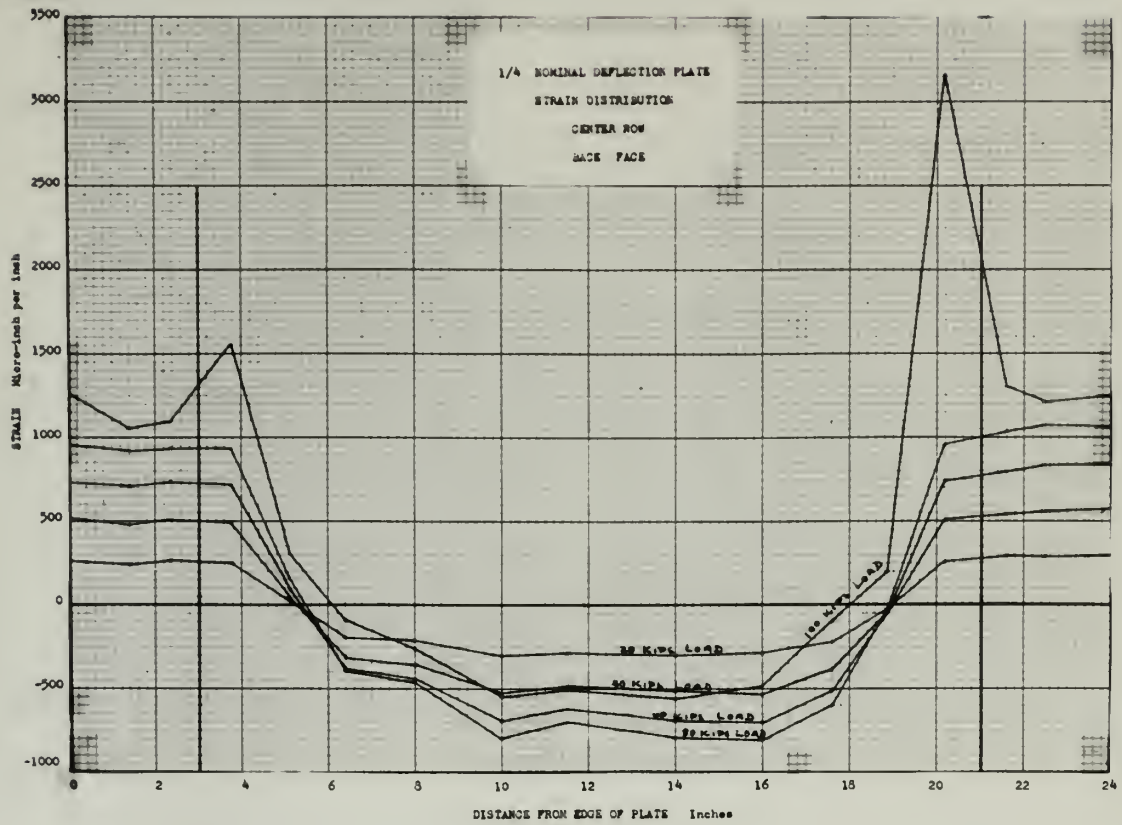


FIGURE LV

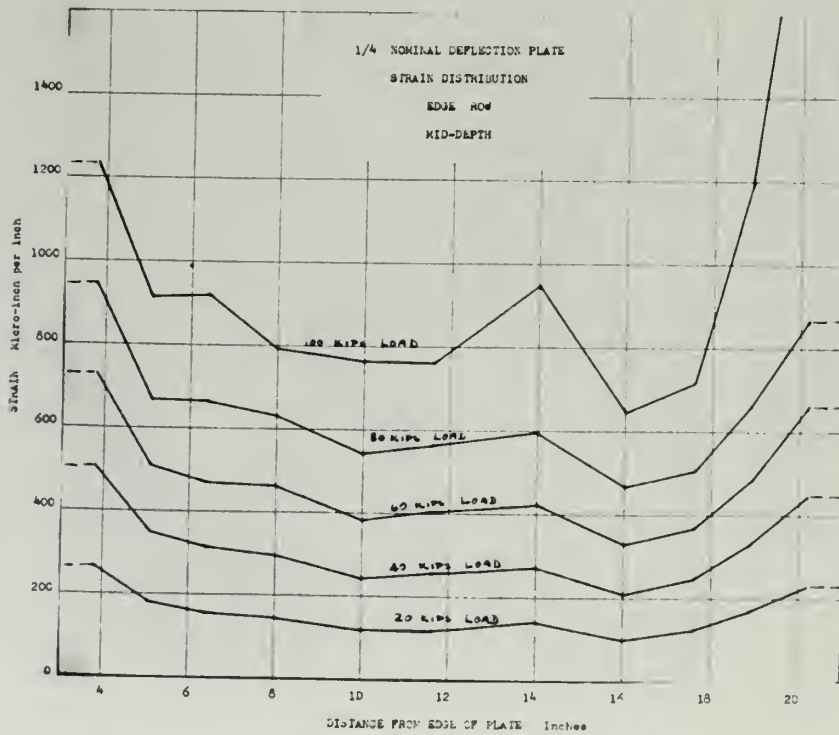
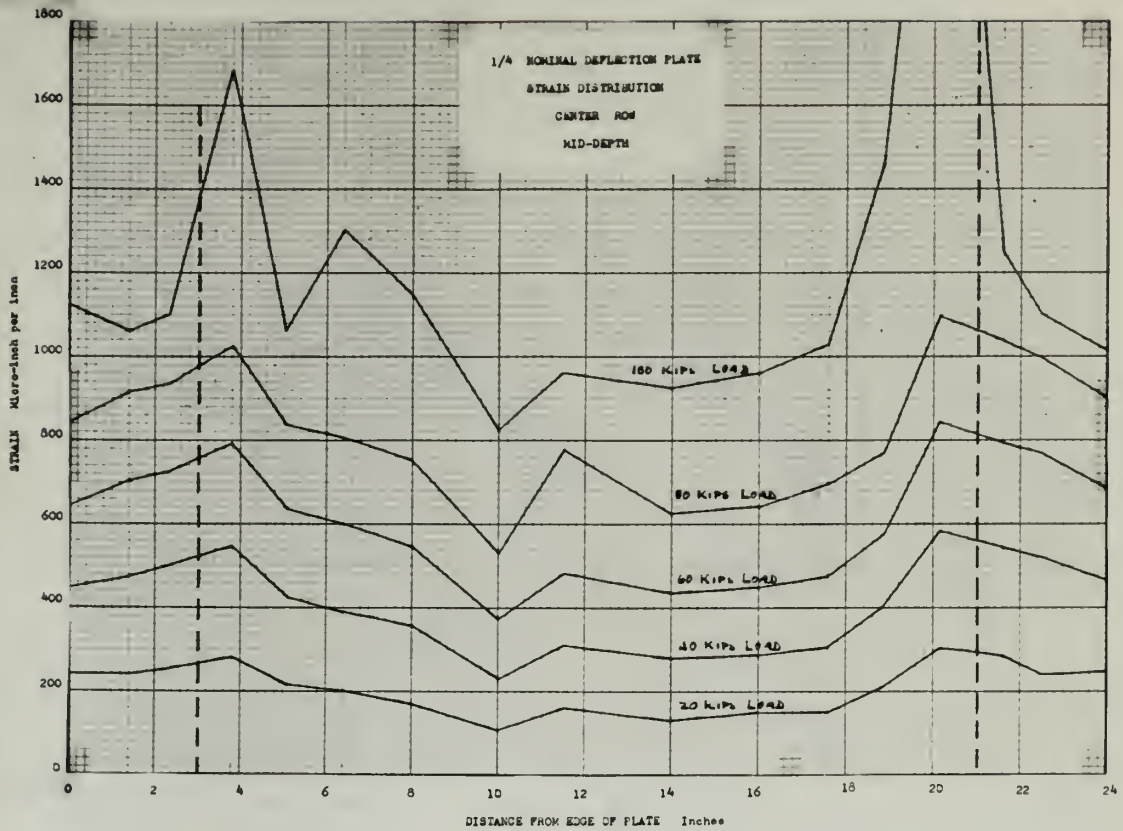


FIGURE LVI

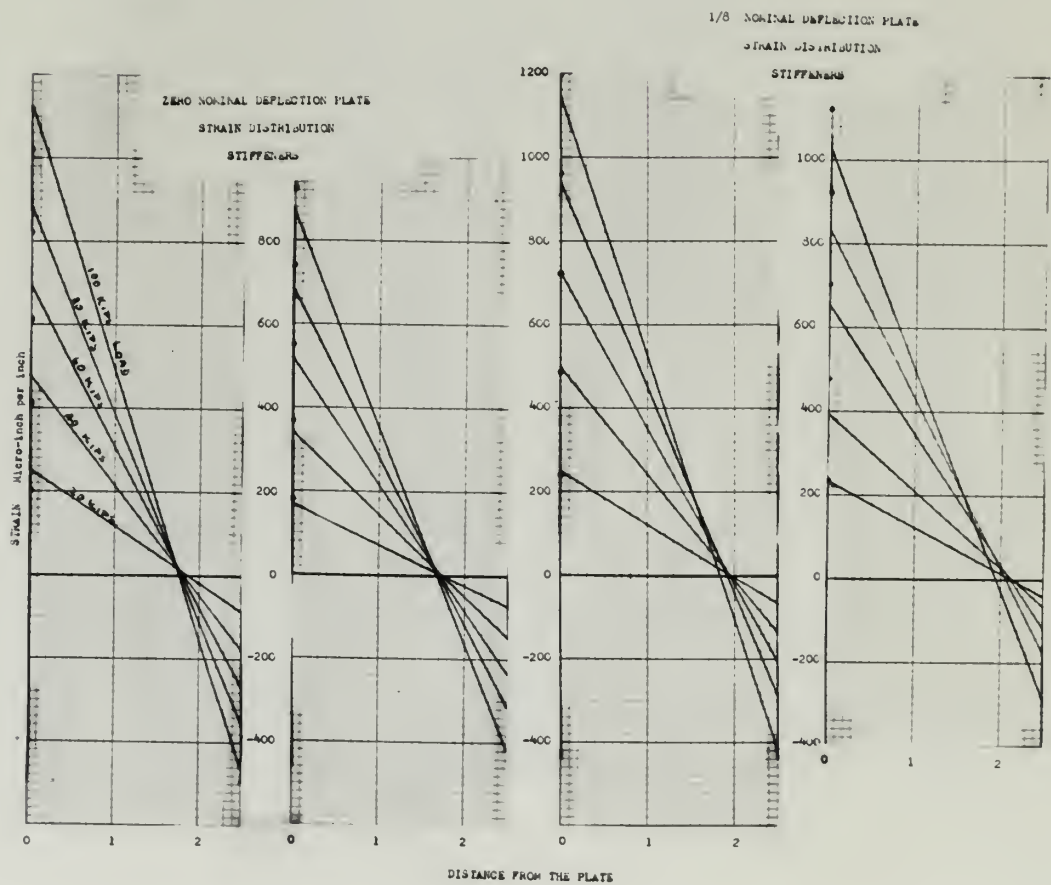
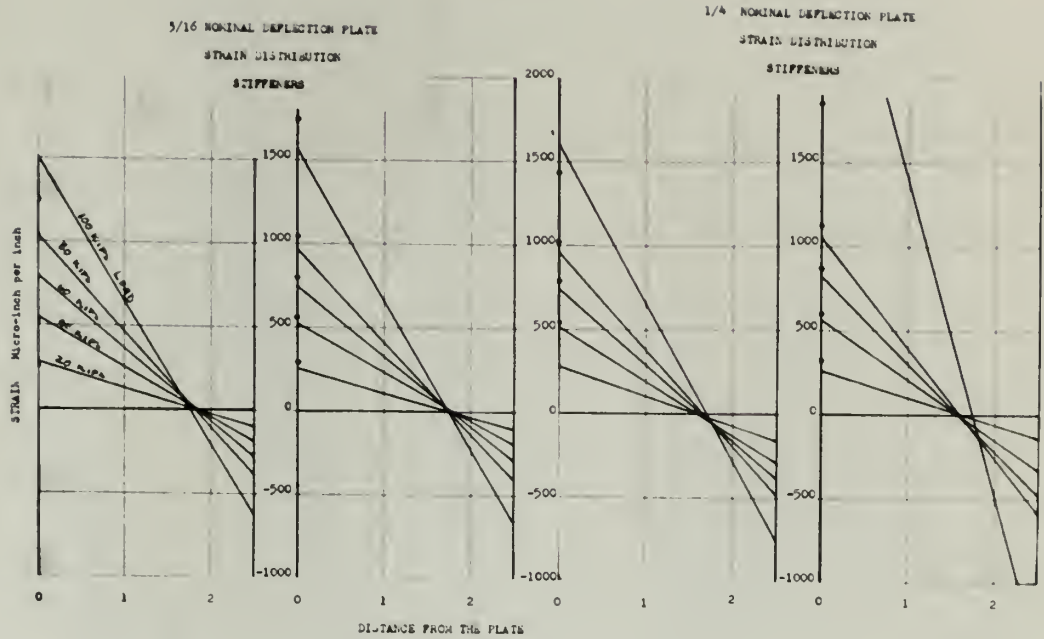
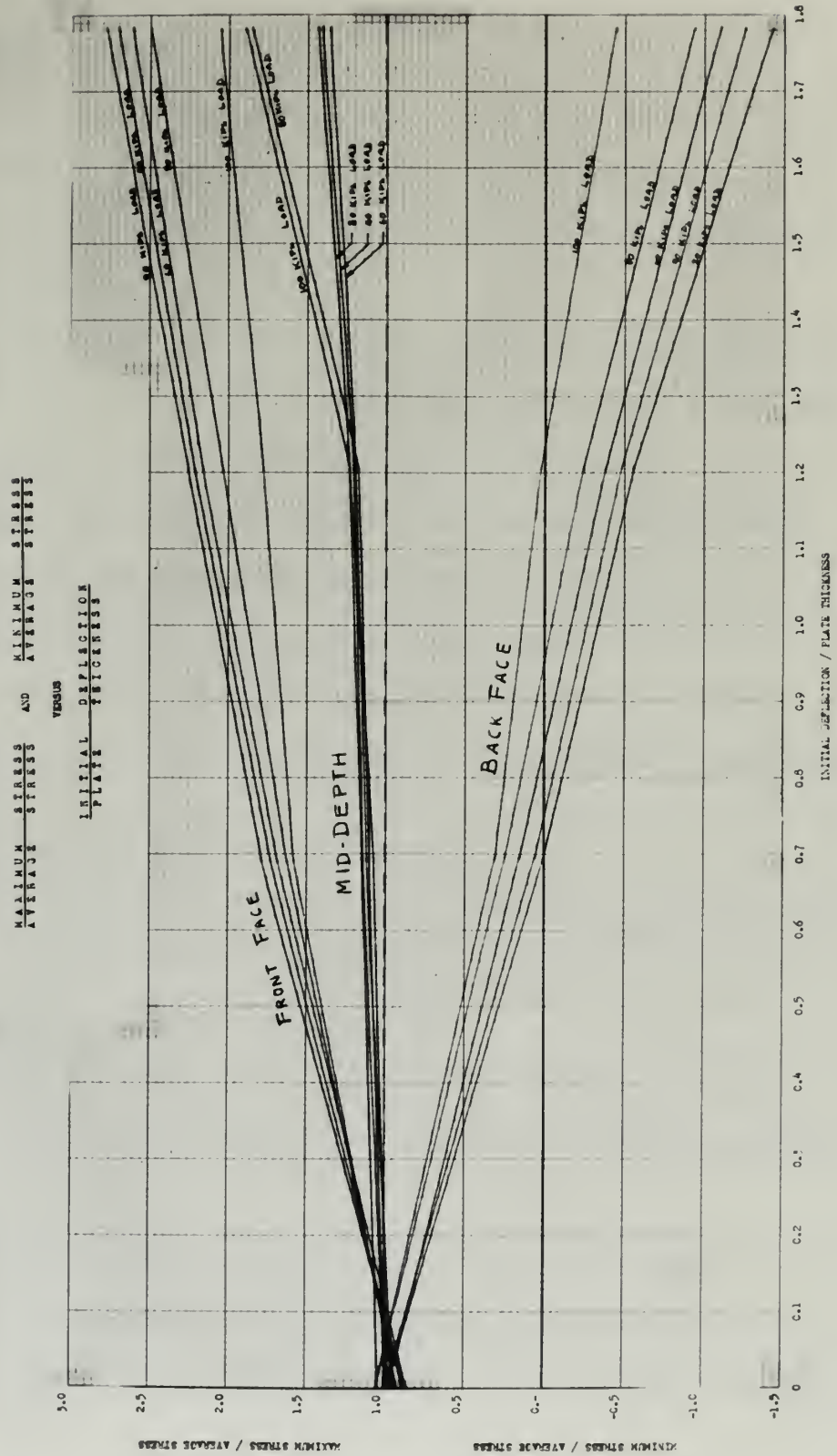


FIGURE LVII



IV DISCUSSION OF THE RESULTS

4.1 Strain-Load Curves

The strain-load curves (Figures IV through XLIII) indicated that the strain-load relation is not linear for the structure tested. The departure from linear performance increases with the increase of initial deflection.

In the 3/16" nominal deflection plate and in the 1/4" nominal deflection plate there were measured strains greater than 2,400 micro-inch per inch for a load of 100 kips, particularly on the front face near the center of the plate. These strains indicate stress values greater than the yield stress of mild steel.

Therefore, it was considered that a strain distribution analysis would provide a more representative indication of what is actually taking place under load than an estimated stress distribution.

4.2 Strains Near the Transverse Stiffeners

The strain gages used to obtain the strain distribution were oriented in the direction of the principal strains indicated by the stress-coat analysis, as explained in section 2.5.

The crack pattern of the stress-coat started to form at a load of about 60 kips, and was completed by the time the load had increased to 80 kips.

It is believed that the orientation of the principal strains changed with the variation of the load because the magnitude of the deflection of the panel probably changed with the load. Therefore, the

A-1 Strain-Load Curves

The strain-load curves (Figure IV through VIII) indicated that the strain-load relation is not linear for the strain rate tested. The decrease from linear performance increased with the increase of initial deflection.

In the 3/16" nominal deflection plate and in the 1/4" nominal deflection plate there were measured strains greater than 2,400 micro-inch per inch for a load of 100 kips, particularly on the front face near the center of the plate. These strains indicate stress values greater than the yield stress of mild steel.

Therefore, it was considered that a strain distribution analysis would provide a more representative indication of what is actually taking place under load than an assumed stress distribution.

A-2 Strain Rate and Transverse Deflection

The strain gages used to obtain the strain distribution were oriented in the direction of the principal strains indicated by the stress-optic analysis, as explained in section 2.5.

The crack pattern of the stress-optic started to form at a load of about 60 kips, and was completed by the time the load had increased to 80 kips.

It is believed that the orientation of the principal strains changed with the variation of the load because the magnitude of the deflection of the panel probably changed with the load. Therefore, the

observations made along the row of strain gages near the stiffeners have a limited significance. Future reference herein to strains should be construed to mean strains measured along the transverse centerline. It should be realized that the strains measured in the row of strain gages near the transverse stiffeners were always lower in value than the maximum strain measured along the transverse centerline even at the loads of 60 to 80 kips; therefore, there is no loss of generality because it is desired to relate a maximum stress to deflection only.

4.3 Strains at the Transverse Centerline of the Panel

The crack pattern of the stress coat for the four plates at the transverse centerline of the panel (Figures IX through XII) had an orientation parallel to the transverse stiffeners, indicating that the orientation of the principal strains at the transverse centerline of the panel did not change with the initial deflection of the plate, and that the orientation of the principal strains was parallel to the longitudinal axis of the specimen.

By symmetry, the direction of the principal strains should be parallel to the longitudinal axis of the specimen.

Therefore, the strains measured with the strain gages at the transverse centerline of the panel, which were installed with their axes oriented parallel to the longitudinal axis of the specimen, are actually the principal strains.

4.4 Strain Distribution in the Unstiffened Side of the Plate

The curves of strain distribution on the unstiffened side of

Observations made along the row of strain gages near the specimen
have a limited significance. Because reference points in strain gages
do correspond to mean strain measured along the transverse direction,
it should be realized that the strains measured in the row of gages
near the transverse direction were always lower in value than
the strains measured along the transverse direction even at the
ends of the specimen; therefore, there is no loss of generality
because it is desired to obtain a maximum strain in collection only.

2.3. Direction of the Transverse Direction of the Panel

The stress pattern of the stress field for the panel is
the transverse direction of the panel (Figure II through III) and an
orientation parallel to the transverse direction, indicating that the
direction of the principal stress at the transverse direction of the
panel did not change with the initial direction of the stress field.
The orientation of the principal stress was parallel to the longitudinal
axis of the specimen.

By symmetry, the direction of the principal stress should be
parallel to the longitudinal axis of the specimen.

Therefore, the strains measured with the strain gages at the
transverse direction of the panel, which were installed with their axis
oriented parallel to the longitudinal axis of the specimen, are actually
the principal strains.

2.4. Strain Distribution in the Uniaxial Case of the Panel

The curves of strain distribution on the uniaxial case of

the plate (Figures XLIV, XLVII, L, and LIII) indicated two maximum strain values at about the quarter points of the transverse centerline of the panel.

4.5 Strain Distribution in the Stiffened Side of the Plate

The curves of strain distribution in the stiffened side of the plate (Figures XLV, XLVIII, LI, and LIV) indicated minimum strain values at about the center of the panel.

4.6 Strain Distribution in the Mid-Depth of the Plate

The curves of strain distribution at the mid-depth of the plate (Figures XLVI, XLIX, LII, and LV) indicated two maximum strain values at the transverse centerline of the panel near to the stiffeners and a minimum strain value at the center of the panel.

4.7 Strain Distribution in the Stiffeners

The strains measured in the stiffeners were always smaller than the average strain in the plate. This indicated that the stiffeners were not sharing the load with the plate, which condition resulted from the load not being applied in line with the position of the neutral axis of the test section. For this reason, a shear load between the plate and the stiffeners existed. The stiffeners were loaded in tension at the bottom edge which caused a bending moment effect on the stiffeners, as can be observed in Figure LVI. The tendency of the shear to produce a compressive effect on the plate reduced the tensile strain in the plate near the stiffeners. Therefore it is believed that the strains in the portion of the plate adjacent to the stiffeners would have a higher value than the measured one if the stiffeners were sharing properly the applied load.

To reduce the shearing force between the plate and the stiffeners the specimens would have to be redesigned. By using stiffeners on both sides of the plate and very stiff members welded at the ends of the test section, an even distribution of load between the stiffeners and the plate would be obtained.

4.8 Strain-Deflection Relationship

Figure LVII shows that the ratios of the maximum stress in the unstiffened side of the plate to the average stress in the plate, of the minimum stress in the stiffened side of the plate to the average stress in the plate, and of the maximum stress in the mid-depth of the plate to the average stress in the plate varied almost linearly with the ratios of the initial deflection to the plate thickness within the elastic region of the material.

The values of the stress ratios mentioned above approach unity as the applied load increases within the elastic region of the material. This effect may be explained if it is realized that the deflection of the panel decreases as the applied load increases.

It should be mentioned that for a load of 80 kips in the $3/16"$ and in the $1/4"$ nominal deflection plates and for a load of 100 kips in all of the plates, the stresses exceeded the yield point of the material, as can be observed in the load-strain curves (Figures XV through XLIII). For this reason, the stress ratio curves of Figure LVII actually indicate for all values of the deflection-thickness ratio and for the load of 80 kips for the range deflection-thickness ratios greater than 1.2.

It follows that the amount of force between the plates and the dielectric
the specimens would have to be considered. The entire dielectric is held
between the plates and very slight movement would be the result of the force
acting on over distention of load between the dielectric and the
plates would be obtained.

4.4. Stress-Deflection Relationship

Figure VIII shows that the ratio of the average stress in the
material at the edge of the plate to the average stress in the body of the
dielectric stress in the interior of the plate to the average stress
in the plate, and of the average stress in the interior of the plate
to the average stress in the plate varied almost linearly with the ratio
of the initial deflection to the plate thickness within the elastic
region of the material.

The values of the stress ratio mentioned above are shown only
as the applied load increases within the elastic region of the material.
This effect may be explained if it is realized that the deflection of the
plate increases as the applied load increases.

It should be mentioned that for a load of 20 kips in the 1/2" x 1/2" x 1/2" material deflection varied up to a load of 20 kips in
all of the plates, the stresses exceeded the yield point of the material.
As can be observed in the load-deflection curves (Figure IX through XIII)
for this reason, the stress ratio curves of Figure VII actually indicate
the all values of the deflection-stress ratio and for the load of 20
kips for the large deflection-stress ratio curves for the 1/2" x 1/2" x 1/2" material.

The data for the large deflection-stress ratio curves for the 1/2" x 1/2" x 1/2" material are shown in Figure X through XIII.

4.9 Section of the Plate Adjacent to the Longitudinal Stiffeners

When the tensile load was applied to the test sections with initial deflection, the maximum stresses in the mid-depth of the plate were produced at the region of the panel adjacent to the longitudinal stiffeners. The material at the center of the panel was initially curved, while the material adjacent to the longitudinal stiffeners was straight; therefore, when the tensile load was applied, the curved fibers were unable to assume a strictly proportionate share of the load.

For an initial-deflection-thickness ratio of 1.5, and a load of 60 kips (8 tons per square inch or 18000 pounds per square inch of average stress in the plate), the calculated ratio of the maximum stress in the mid-depth of the plate at the region adjacent to the longitudinal stiffeners to the average stress in the plate was 1.275. Because the stiffeners did not share the load with the plate, it is believed that this value should be larger. This stress ratio is the stress concentration factor produced by the initial deflection of the panel.

4.10 Center Section of the Panel

When the tensile load was applied on the test sections with initial deflection, the maximum stresses were produced at the center of the panel in the unstiffened side of the plate, and the minimum values of the tensile strain were obtained in the same region in the stiffened side. The center of the panel was by a direct tensile load and by a bending load due to the deflection. The sum of these loads caused a high tensile stress in the concave side of the panel (unstiffened face), and a low tensile stress, some times negative (compressive stress) in the convex side of the plate (stiffened face).

4.9 Location of the Initial Deflection

When the family load was applied to the test section and initial deflection, the section stresses in the middle of the plate were produced as the region of the panel adjacent to the longitudinal stiffener. The material at the center of the panel was initially curved, with the material adjacent to the longitudinal stiffener was straight; therefore, when the family load was applied, the curved fibers were unable to remain a strictly proportional share of the load. For an initial-deflection-tension ratio of 1.5, and a load of 10 kips (2 tons per square inch on 1800 square inch net square inch of average stress in the plate), the calculated ratio of the maximum stress to the mid-length of the plate at the region adjacent to the longitudinal stiffener to the average stress in the plate was 1.475. Because the stiffeners did not share the load with the plate, it is believed that this value should be larger. This stress ratio is the stress concentration factor produced by the initial deflection of the panel.

4.10 Upper Location of the Load

When the family load was applied on the test section with initial deflection, the section stresses were produced in the center of the panel as the initial stress in the plate, and the minimum values of the family stress were obtained in the same region in the opposite side. The center of the panel was by a slight curve but by a bending load was in the deflection. The use of these loads caused a high tensile stress in the center area of the panel (initial stress), and a low tensile stress near the negative (compressive stress) in the corner side of the plate (stiffened face).

For an initial-deflection-plate thickness ratio of 1.5, and a load of 60 kips (about 8 tons persquare inch or 18000 pounds per square inch of average stress in the plate), the calculated ratio of the maximum stress at the center of the panel in the unstiffened (concave) side of the plate to the average stress in the plate was 2.39. Because the stiffeners did not share the load with the plate, it is believed that the direct tensile stress at the center of the plate would be smaller. However, the bending moment would be larger. The net effect cannot be estimated. The bending moment would be larger, because, if the stiffeners worked fully, the neutral axis of the section (or line of application of the load) would be at a larger distance from the plate at the center of the panel. This calculated stress ratio is the stress concentration factor produced by the initial deflection of the panel.

The stress concentration factor for the unstiffened side of the plate in the central region of the panel is much higher than that for the region of the plate adjacent to the longitudinal stiffeners. Considering the big difference between these two stress concentration factors, it is believed that the stress concentration factor for the central region of the panel would still be the largest one even if the stiffeners properly shared the load.

This stress concentration at the center of the unstiffened side combined with alternation of stresses, is a sufficient cause to produce surface cracks in the plate, which in turn increase the stress concentration causing the complete failure of the plate.

The above concentration factor for the central region of the plate is much higher than that for the region of the plate adjacent to the longitudinal extension. Considering the big difference between these two stress concentration factors, it is believed that the stress concentration factor for the central region of the plate would still be the largest one even if the extension property shared the load.

This stress concentration at the center of the unnotched side combined with elevation of stresses, is a sufficient cause to produce surface cracks in the plate, which in turn increases the stress concentration around the cracked surface of the plate.

V CONCLUSIONS

- 5.1 In the unstiffened side of the deflected panels, the maximum stresses are produced at the quarter points of the transverse centerline of the panel.
- 5.2 In the stiffened side of the deflected panels, the minimum stresses are produced at the center of the panel.
- 5.3 In the mid-depth of the deflected panels, the maximum stresses are produced in a region adjacent to the longitudinal stiffeners at the transverse centerline of the panel, and the minimum stresses at the center of the panel.
- 5.4 The ratios of the maximum to the average stress values increase almost linearly with the increase of initial-deflection-plate-thickness ratio within the elastic region of the material. The ratios of the minimums to the average stress values decrease almost linearly with the increase of the initial-deflection-plate-thickness ratio within the elastic region of the material.
- 5.5 The ratios of the maximums to the average stress values and of the minimums to the average stress values approach unity as the applied load increases within the elastic region of the material.
- 5.6 The high stress concentrations in the unstiffened side of the plate (concave side) caused by large initial deflections, combined with alternation of stresses, produce surface cracks in the plate.

2.1 In the uniaxial case of the deformed metal, the average stress is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

2.2 In the uniaxial case of the deformed metal, the average stress is assumed to be constant at the point of the fracture.

2.3 In the uniaxial case of the deformed metal, the average stress is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

2.4 The ratio of the average stress to the average strain is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

2.5 The ratio of the average stress to the average strain is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

2.6 The ratio of the average stress to the average strain is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

2.7 The ratio of the average stress to the average strain is assumed to be constant at the point of the fracture, and the average strain is assumed to be constant.

VI RECOMMENDATIONS

- 6.1 To reduce the shearing force between the plate and the stiffeners, the specimen should be redesigned using stiffeners on both sides of the plate and very stiff members welded at the ends of the test section so that an even distribution of the load between the stiffeners and the plate would result.
- 6.2 Investigations should be continued with different aspect ratios until sufficient data is compiled to specify a maximum allowable deflection of panels.

1. To ensure the proper force between the plate and the cylinder, the pressure should be regulated with sufficient care to avoid any possibility of damage to the plate.

The plate was very thin and was held at the edge of the last.

It was found that the pressure of the fluid between the

plates was not uniform.

2. The pressure should be regulated with sufficient care to avoid any possibility of damage to the plate.

The pressure was not uniform and was held at the edge of the last.

of plates.

The pressure was not uniform and was held at the edge of the last.

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VII APPENDIX

The first of these is the fact that the...
the second is the fact that the...
the third is the fact that the...
the fourth is the fact that the...
the fifth is the fact that the...
the sixth is the fact that the...
the seventh is the fact that the...
the eighth is the fact that the...
the ninth is the fact that the...
the tenth is the fact that the...

CHAPTER IV

The first of these is the fact that the...
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the third is the fact that the...
the fourth is the fact that the...
the fifth is the fact that the...
the sixth is the fact that the...
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APPENDIX A

TEST DATA

A. L. L. L. L.

AND THE

TABLE I
DATA SHEET
INITIAL DEFLECTION READINGS
PLATE OF ZERO NOMINAL DEFLECTION

Station	1	2	3	4	5	6	7	8	9	10	11
1	0	1	1	5	6	9	12	14	13	7	0
2	2	4	5	9	13	15	19	19	17	13	11
3	1	3	3	6	8	9	15	17	16	15	14
4	-5	-0	-2	-1	1	3	8	12	15	17	16
5	-7	-5	-9	-7	-4	-2	0	6	8	12	14
6	-11	-10	-14	-12	-7	-11	-7	-4	3	8	11
7	-15	-13	-17	-15	-10	-9	-13	-4	1	6	9
8	-20	-13	-14	-9	-6	1	11	16	10	7	7
9	-21	-7	-2	-1	0	4	14	18	16	8	2
10	-24	1	11	5	4	6	14	18	14	7	0
11	-26	-8	2	5	6	7	12	14	13	8	0
12	-26	-13	-7	-1	2	5	10	14	16	11	-1
13	-33	-21	-15	-7	-3	0	6	10	13	6	-7
14	-37	-27	-22	-13	-8	-6	1	6	6	0	-10
15	-39	-32	-26	-18	-13	-10	-4	1	-1	-5	-10
16	-39	-34	-32	-24	-18	-13	-9	-4	-5	-8	-10
17	-44	-40	-37	-29	-23	-19	-11	-8	-8	-9	-9
18	-53	-44	-40	-32	-27	-22	-14	-9	-10	-9	-7
19	-51	-46	-43	-34	-29	-24	-15	-10	-11	-8	-6
20	-55	-49	-44	-36	-29	-25	-15	-10	-9	-8	-6
21	-55	-49	-46	-37	-30	-25	-14	-9	-8	-6	-3
22	-55	-51	-48	-39	-30	-25	-14	-8	-7	-4	-3
23	-61	-55	-49	-40	-30	-25	-15	-7	-5	-3	-2
24	-64	-57	-52	-42	-31	-25	-16	-8	-6	-3	1
25	-64	-57	-52	-42	-33	-27	-18	-11	-9	-4	0
26	-58	-58	-50	-50	-32	-27	-19	-15	-12	-8	-5
27	-52	-48	-46	-26	-28	-25	-22	-18	-15	-10	-6
28	-47	-42	-42	-36	-25	-26	-22	-19	-16	-10	-6
29	-37	-34	-39	-35	-27	-30	-25	-20	-16	-9	-5
30	-29	-28	-33	-31	-26	-25	-25	-17	-12	-7	-2
31	-22	-21	-27	-25	-21	-19	-13	-11	-9	-7	-1
32	-16	-14	-20	-19	-19	-18	-11	-6	-4	-3	-1
33	-9	-9	-13	-12	-14	-13	-8	-1	1	1	0
34	-3	-1	-4	-5	-6	-18	-2	6	7	8	6
34	0	7	7	6	1	-2	3	13	14	14	6

1. Readings in thousandth of an inch
2. Station $\frac{1}{2}$ inch spaced

Year	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1900	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	

1. Station in thousands of sq inch
2. Station in inch space

TABLE I (continued)
DATA SHEET
INITIAL DEFLECTION READINGS
PLATE OF 1/8" NOMINAL DEFLECTION

Station	1	2	3	4	5	6	7	8	9	10	11
0	0	-6	-9	-15	-17	-13	-7	-3	-1	-2	0
1	5	5	14	12	15	15	17	22	19	8	4
2	8	21	47	59	52	49	57	66	60	34	9
3	13	37	64	76	79	80	89	67	85	53	18
4	17	56	78	91	102	104	104	99	92	53	15
5	17	63	89	95	100	99	98	95	80	44	11
6	15	58	86	93	97	98	99	93	83	43	10
7	7	27	76	87	93	97	100	95	95	62	10
8	8	40	69	83	93	91	97	98	89	54	9
9	9	35	66	79	85	89	98	100	95	50	5
10	10	35	62	78	83	83	94	98	99	49	6
11	11	36	71	83	93	89	93	96	87	50	6
12	12	41	74	88	93	86	92	94	81	50	9
13	10	36	70	87	88	79	87	85	73	33	1
14	7	34	68	85	84	78	85	83	69	30	-2
15	5	35	73	83	87	82	92	90	73	33	-4
16	-3	35	64	76	85	86	99	92	76	31	-8
17	-11	26	58	73	78	84	95	90	76	31	-13
18	-17	22	54	73	82	85	90	87	86	35	-14
19	-26	18	51	72	83	83	86	83	78	38	-14
20	-23	20	62	78	78	85	82	79	77	41	-13
21	-22	24	54	68	76	78	74	70	73	40	-12
22	-16	25	57	74	78	79	80	78	75	35	-11
23	-17	20	52	68	77	82	84	78	69	27	-13
24	-16	15	47	69	77	78	83	77	67	21	-13
25	-16	14	48	66	73	71	81	76	66	22	-13
26	-15	20	51	66	73	72	77	76	66	23	-12
27	-12	29	58	72	76	82	80	79	73	29	-6
28	-10	35	67	76	74	74	79	81	82	35	-2
29	-6	41	64	76	80	85	84	87	84	36	-1
30	-3	37	68	80	79	86	83	93	81	36	2
31	-1	46	73	88	83	87	89	94	80	44	11
32	4	53	64	78	75	77	80	77	75	50	20
33	2	30	43	50	51	54	60	56	57	37	16
34	-1	9	39	23	22	26	31	34	36	26	18
35	-2	-3	2	0	-10	-8	6	24	31	26	25
36	0	-6	-4	-4	-5	-4	0	7	9	10	14

Year	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	

TABLE I (continued)
DATA SHEET
INITIAL DEFLECTION READINGS
PLATE OF 3/16" NOMINAL DEFLECTION

Station	1	2	3	4	5	6	7	8	9	10	11
0	0	1	-3	-6	-8	-8	-7	-6	-4	-4	0
1	2	24	34	26	24	28	22	20	18	6	-3
2	10	48	80	81	81	80	79	69	56	30	4
3	8	53	89	111	118	120	127	107	88	43	2
4	6	55	98	121	136	134	136	120	101	49	-3
5	4	56	97	125	138	144	143	128	109	48	-11
6	4	57	95	119	127	137	135	126	112	47	-12
7	8	62	100	118	126	131	128	120	97	31	-32
8	10	64	102	123	128	135	135	116	78	16	-38
9	11	61	101	124	133	142	140	113	76	11	-44
10	12	60	102	125	134	140	133	115	81	12	-46
11	17	62	102	124	137	139	132	117	80	15	-46
12	21	70	108	122	139	141	134	115	76	8	-50
13	25	87	127	141	150	147	136	116	83	10	-51
14	32	108	139	146	150	145	135	113	82	15	-56
15	33	103	138	140	147	143	135	109	82	15	-59
16	31	111	135	135	143	145	136	114	83	7	-64
17	33	105	130	135	141	143	140	112	82	7	-66
18	33	104	127	135	140	139	136	110	79	7	-66
19	31	101	127	136	139	137	127	154	71	1	-66
20	30	91	124	131	134	132	118	93	64	-7	-65
21	29	88	120	127	131	127	115	88	51	-11	-66
22	28	81	112	124	130	131	119	87	51	-9	-65
23	27	75	109	124	133	138	123	96	61	6	-58
24	27	72	109	119	129	133	124	106	66	6	-56
25	25	66	96	116	130	127	127	99	57	2	-50
26	24	62	94	113	123	127	126	99	52	-6	-52
27	25	64	99	118	125	124	118	98	52	-10	-53
28	26	65	98	113	125	122	111	86	51	-10	-50
29	26	62	90	110	121	117	103	79	47	-8	-46
30	26	58	84	105	113	109	97	78	50	-1	-41
31	25	54	78	92	97	99	93	76	60	9	-32
32	23	46	66	78	85	89	81	64	52	15	-25
33	20	36	55	67	68	69	54	44	38	6	-20
34	13	22	37	45	42	39	27	14	13	-5	-19
35	7	7	6	3	0	1	-6	-11	-10	-15	-18
36	0	-4	-7	-13	-16	-17	-20	-24	-19	-21	-18

[illegible]

TABLE I (continued)
DATA SHEET
INITIAL DEFLECTION READINGS
PLATE OF 1/4" NOMINAL DEFLECTION

Station		1	2	3	4	5	6	7	8	9	10	11	12
0	0	2	0	-2	-5	-6	-9	-11	-7	-7	-7	-4	0
1	0	1	7	13	11	7	4	2	1	4	2	3	-1
2	-1	5	20	36	40	47	38	31	22	14	6	4	-3
3	-6	4	31	58	78	77	68	62	44	25	12	3	-6
4	-14	1	31	77	107	111	111	91	63	37	17	-1	-15
5	-21	-4	48	98	117	124	131	105	74	48	22	-5	-21
6	-27	-10	57	104	119	128	138	115	83	57	28	-12	-30
7	-27	-15	53	100	116	137	136	137	81	50	20	-18	-38
8	-27	-16	43	100	123	144	140	119	84	50	16	-24	-45
9	-25	-19	39	95	127	146	141	127	100	52	19	-28	-48
10	-26	-17	35	93	131	147	146	136	115	77	24	-32	-59
11	-24	-13	39	99	138	153	164	155	126	89	30	-33	-58
12	-27	-14	45	106	142	156	176	168	136	95	35	-36	-62
13	-26	-11	62	117	147	165	183	180	146	104	48	-36	-67
14	-25	-3	81	126	151	171	189	189	153	107	52	-27	-71
15	-26	-5	74	141	151	172	193	194	152	104	43	-39	-72
16	-29	-4	74	129	153	169	190	188	149	103	46	-40	-71
17	-32	-1	87	130	160	175	188	187	147	106	44	-36	-68
18	-33	-2	78	127	160	178	194	187	152	108	46	-31	-63
19	-34	-3	68	116	145	175	200	190	155	116	52	-27	-57
20	-30	-1	65	122	153	179	205	199	161	111	59	-17	-49
21	-25	0	67	126	161	179	207	202	171	121	69	-7	-40
22	-19	1	72	130	162	186	208	203	174	124	67	-2	-32
23	-21	-1	66	122	155	180	207	201	168	123	67	0	-25
24	-23	-2	61	117	155	183	208	201	165	121	65	3	-19
25	-25	-3	61	118	157	190	209	201	165	117	63	3	-17
26	-26	-5	55	113	151	188	207	198	164	112	60	4	-16
27	-28	-9	51	110	149	186	199	193	164	110	60	6	-14
28	-31	-9	44	99	150	189	201	195	165	111	61	9	-13
29	-31	-6	44	97	144	186	203	198	170	115	66	13	-6
30	-28	-4	46	98	137	181	200	198	173	124	72	21	-2
31	-22	0	46	92	130	172	192	195	178	128	80	28	6
32	-15	4	46	87	117	153	176	186	174	126	64	32	13
33	-8	6	39	69	89	116	152	161	158	117	72	31	17
34	-2	8	27	40	56	70	92	102	96	80	49	27	21
35	0	7	15	18	23	26	24	29	33	26	24	21	22
36	0	6	1	-2	9	4	5	7	12	9	14	17	19

TABLE I (continued)
 1941-1942
 UNITED STATES DEPARTMENT OF AGRICULTURE
 NATIONAL BUREAU OF ECONOMIC RESEARCH

Station		1941		1942		1943		1944		1945		1946		1947		1948		1949		1950		1951		1952		1953		1954		1955		1956		1957		1958		1959		1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970		1971		1972		1973		1974		1975		1976		1977		1978		1979		1980		1981		1982		1983		1984		1985		1986		1987		1988		1989		1990		1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029		2030		2031		2032		2033		2034		2035		2036		2037		2038		2039		2040		2041		2042		2043		2044		2045		2046		2047		2048		2049		2050		2051		2052		2053		2054		2055		2056		2057		2058		2059		2060		2061		2062		2063		2064		2065		2066		2067		2068		2069		2070		2071		2072		2073		2074		2075		2076		2077		2078		2079		2080		2081		2082		2083		2084		2085		2086		2087		2088		2089		2090		2091		2092		2093		2094		2095		2096		2097		2098		2099		2100		2101		2102		2103		2104		2105		2106		2107		2108		2109		2110		2111		2112		2113		2114		2115		2116		2117		2118		2119		2120		2121		2122		2123		2124		2125		2126		2127		2128		2129		2130		2131		2132		2133		2134		2135		2136		2137		2138		2139		2140		2141		2142		2143		2144		2145		2146		2147		2148		2149		2150		2151		2152		2153		2154		2155		2156		2157		2158		2159		2160		2161		2162		2163		2164		2165		2166		2167		2168		2169		2170		2171		2172		2173		2174		2175		2176		2177		2178		2179		2180		2181		2182		2183		2184		2185		2186		2187		2188		2189		2190		2191		2192		2193		2194		2195		2196		2197		2198		2199		2200		2201		2202		2203		2204		2205		2206		2207		2208		2209		2210		2211		2212		2213		2214		2215		2216		2217		2218		2219		2220		2221		2222		2223		2224		2225		2226		2227		2228		2229		2230		2231		2232		2233		2234		2235		2236		2237		2238		2239		2240		2241		2242		2243		2244		2245		2246		2247		2248		2249		2250		2251		2252		2253		2254		2255		2256		2257		2258		2259		2260		2261		2262		2263		2264		2265		2266		2267		2268		2269		2270		2271		2272		2273		2274		2275		2276		2277		2278		2279		2280		2281		2282		2283		2284		2285		2286		2287		2288		2289		2290		2291		2292		2293		2294		2295		2296		2297		2298		2299		2300		2301		2302		2303		2304		2305		2306		2307		2308		2309		2310		2311		2312		2313		2314		2315		2316		2317		2318		2319		2320		2321		2322		2323		2324		2325		2326		2327		2328		2329		2330		2331		2332		2333		2334		2335		2336		2337		2338		2339		2340		2341		2342		2343		2344		2345		2346		2347		2348		2349		2350		2351		2352		2353		2354		2355		2356		2357		2358		2359		2360		2361		2362		2363		2364		2365		2366		2367		2368		2369		2370		2371		2372		2373		2374		2375		2376		2377		2378		2379		2380		2381		2382		2383		2384		2385		2386		2387		2388		2389		2390		2391		2392		2393		2394		2395		2396		2397		2398		2399		2400		2401		2402		2403		2404		2405		2406		2407		2408		2409		2410		2411		2412		2413		2414		2415		2416		2417		2418		2419		2420		2421		2422		2423		2424		2425		2426		2427		2428		2429		2430		2431		2432		2433		2434		2435		2436		2437		2438		2439		2440		2441		2442		2443		2444		2445		2446		2447		2448		2449		2450		2451		2452		2453		2454		2455		2456		2457		2458		2459		2460		2461		2462		2463		2464		2465		2466		2467		2468		2469		2470		2471		2472		2473		2474		2475		2476		2477		2478		2479		2480		2481		2482		2483		2484		2485		2486		2487		2488		2489		2490		2491		2492		2493		2494		2495		2496		2497		2498		2499		2500		2501		2502		2503		2504		2505		2506		2507		2508		2509		2510		2511		2512		2513		2514		2515		2516		2517		2518		2519		2520		2521		2522		2523		2524		2525		2526		2527		2528		2529		2530		2531		2532		2533		2534		2535		2536		2537		2538		2539		2540		2541		2542		2543		2544		2545		2546		2547		2548		2549		2550		2551		2552		2553		2554		2555		2556		2557		2558		2559		2560		2561		2562		2563		2564		2565		2566		2567		2568		2569		2570		2571		2572		2573		2574		2575		2576		2577		2578		2579		2580		2581		2582		2583		2584		2585		2586		2587		2588		2589		2590		2591		2592		2593		2594		2595		2596		2597		2598		2599		2600		2601		2602		2603		2604		2605		2606		2607		2608		2609		2610		2611		2612		2613		2614		2615		2616		2617		2618		2619		2620		2621		2622		2623		2624		2625		2626		2627		2628		2629		2630		2631		2632		2633		2634		2635		2636		2637		2638		2639		2640		2641		2642		2643		2644		2645		2646		2647		2648		2649		2650		2651		2652		2653		2654		2655		2656		2657		2658		2659		2660		2661		2662		2663		2664		2665		2666		2667		2668		2669		2670		2671		2672		2673		2674		2675		2676		2677		2678		2679		2680		2681		2682		2683		2684		2685		2686		2687		2688		2689		2690		2691		2692		2693		2694		2695		2696		2697		2698		2699		2700		2701		2702		2703		2704		2705		2706		2707		2708		2709		2710		2711		2712		2713		2714		2715		2716		2717		2718		2719		2720		2721		2722		2723		2724		2725		2726		2727		2728		2729		2730		2731		2732		2733		2734		2735		2736		2737		2738		2739		2740		2741		2742		2743		2744		2745		2746		2747		2748		2749		2750		2751		2752		2753		2754		2755		2756		2757		2758		2759		2760		2761		2762		2763		2764		2765		2766		2767		2768		2769		2770		2771		2772	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TABLE II

Location of Strain Gages

Plate (nominal deflection)		0	1/8"	3/16"	1/4"
Gage Number		Distance from left edge (in)			
1		12.4	0.4	0.4	0.4
2		1.4	1.4	1.4	1.4
3		2.3	2.3	2.3	2.3
4	18	3.75	3.75	3.75	3.75
5	19	5.1	5.1	5.1	5.1
6	20	6.5	6.4	6.4	6.4
7	21	8.0	8.0	8.0	8.0
8	22	10.0	10.0	10.0	10.0
9	23	12.0	12.0	12.0	11.5
10	24	14.0	14.0	14.0	14.0
11	25	16.0	16.0	16.0	16.0
12	26	17.0	17.35	17.6	17.6
13	27	18.75	18.75	18.9	18.9
14	28	20.2	20.1	20.15	20.15
15		21.6	21.6	21.6	21.6
16		22.7	22.5	22.5	22.5
17		23.5	23.5	23.5	23.5
		Distance from outer edge			
A	D	0.5	0.5	0.5	0.5
B	C	1.7	1.7	1.7	1.7
E	H	0.5	0.5	0.5	0.5
F	G	1.7	1.7	1.7	1.7

Summary of Results

Plane (nominal deflection)	0	1/8"	3/16"	1/4"
Beam number	Distance from left end (in)			
1	10.4	10.4	10.4	10.4
2	1.4	1.4	1.4	1.4
3	5.3	5.3	5.3	5.3
4	3.75	3.75	3.75	3.75
5	2.1	2.1	2.1	2.1
6	4.5	4.5	4.5	4.5
7	7.0	7.0	7.0	7.0
8	10.0	10.0	10.0	10.0
9	12.0	12.0	12.0	12.0
10	14.0	14.0	14.0	14.0
11	16.0	16.0	16.0	16.0
12	17.0	17.0	17.0	17.0
13	17.5	17.5	17.5	17.5
14	18.2	18.2	18.2	18.2
15	18.6	18.6	18.6	18.6
16	18.7	18.7	18.7	18.7
17	18.8	18.8	18.8	18.8
18	18.9	18.9	18.9	18.9
19	19.0	19.0	19.0	19.0
20	19.1	19.1	19.1	19.1
21	19.2	19.2	19.2	19.2
22	19.3	19.3	19.3	19.3
23	19.4	19.4	19.4	19.4
24	19.5	19.5	19.5	19.5
25	19.6	19.6	19.6	19.6
26	19.7	19.7	19.7	19.7
27	19.8	19.8	19.8	19.8
28	19.9	19.9	19.9	19.9
29	20.0	20.0	20.0	20.0
30	20.1	20.1	20.1	20.1
31	20.2	20.2	20.2	20.2
32	20.3	20.3	20.3	20.3
33	20.4	20.4	20.4	20.4
34	20.5	20.5	20.5	20.5
35	20.6	20.6	20.6	20.6
36	20.7	20.7	20.7	20.7
37	20.8	20.8	20.8	20.8
38	20.9	20.9	20.9	20.9
39	21.0	21.0	21.0	21.0
40	21.1	21.1	21.1	21.1
41	21.2	21.2	21.2	21.2
42	21.3	21.3	21.3	21.3
43	21.4	21.4	21.4	21.4
44	21.5	21.5	21.5	21.5
45	21.6	21.6	21.6	21.6
46	21.7	21.7	21.7	21.7
47	21.8	21.8	21.8	21.8
48	21.9	21.9	21.9	21.9
49	22.0	22.0	22.0	22.0
50	22.1	22.1	22.1	22.1
51	22.2	22.2	22.2	22.2
52	22.3	22.3	22.3	22.3
53	22.4	22.4	22.4	22.4
54	22.5	22.5	22.5	22.5
55	22.6	22.6	22.6	22.6
56	22.7	22.7	22.7	22.7
57	22.8	22.8	22.8	22.8
58	22.9	22.9	22.9	22.9
59	23.0	23.0	23.0	23.0
60	23.1	23.1	23.1	23.1
61	23.2	23.2	23.2	23.2
62	23.3	23.3	23.3	23.3
63	23.4	23.4	23.4	23.4
64	23.5	23.5	23.5	23.5
65	23.6	23.6	23.6	23.6
66	23.7	23.7	23.7	23.7
67	23.8	23.8	23.8	23.8
68	23.9	23.9	23.9	23.9
69	24.0	24.0	24.0	24.0
70	24.1	24.1	24.1	24.1
71	24.2	24.2	24.2	24.2
72	24.3	24.3	24.3	24.3
73	24.4	24.4	24.4	24.4
74	24.5	24.5	24.5	24.5
75	24.6	24.6	24.6	24.6
76	24.7	24.7	24.7	24.7
77	24.8	24.8	24.8	24.8
78	24.9	24.9	24.9	24.9
79	25.0	25.0	25.0	25.0
80	25.1	25.1	25.1	25.1
81	25.2	25.2	25.2	25.2
82	25.3	25.3	25.3	25.3
83	25.4	25.4	25.4	25.4
84	25.5	25.5	25.5	25.5
85	25.6	25.6	25.6	25.6
86	25.7	25.7	25.7	25.7
87	25.8	25.8	25.8	25.8
88	25.9	25.9	25.9	25.9
89	26.0	26.0	26.0	26.0
90	26.1	26.1	26.1	26.1
91	26.2	26.2	26.2	26.2
92	26.3	26.3	26.3	26.3
93	26.4	26.4	26.4	26.4
94	26.5	26.5	26.5	26.5
95	26.6	26.6	26.6	26.6
96	26.7	26.7	26.7	26.7
97	26.8	26.8	26.8	26.8
98	26.9	26.9	26.9	26.9
99	27.0	27.0	27.0	27.0
100	27.1	27.1	27.1	27.1

TABLE III
DATA SHEET
STRAIN LOAD READINGS
PLATE OF ZERO NOMINAL DEFLECTION
FRONT FACE

LOAD IN POUNDS

GAGE NUMBER	0	15000	30000	45000	60000	75000	90000	105000
1	10-1915	12-195	12-425	12-625	12-850	12-1050	12-1260	12-1410
2*	8-1045	8-1260	8-1500	8-1675	8-1880	10-65	10-240	10-335
3	14-0030	14-240	14-425	14-580	14-760	14-930	14-1090	14-1230
4*	8-1225	8-1400	8-1570	8-1715	8-1880	10-30	10-180	10-335
5	14-0010	14-175	14-320	14-460	14-630	14-775	14-925	14-1050
6	8-1170	8-1320	8-1475	8-1615	8-1760	8-1930	10-90	10-240
7	8-1465	8-1600	8-1755	8-1900	10-70	10-220	10-370	10-480
8	10-175	10-310	10-460	10-620	10-800	10-965	10-1125	10-1200
9	14-1075	14-1200	14-1350	14-1510	14-1700	14-1870	16-40	16-180
10	14-920	14-1030	14-1170	14-1320	14-1500	14-1660	14-1820	14-1990
11	14-1170	14-1285	14-1420	14-1545	14-1710	14-1870	16-15	16-180
12	12-1820	12-1925	14-45	14-160	14-310	14-440	14-580	14-810
13	14-50	14-165	14-290	14-400	14-530	14-660	14-790	14-935
14	12-1480	12-1620	12-1760	12-1885	14-20	14-160	14-300	14-430
15	14-445	14-605	14-765	14-905	14-1070	14-1220	14-1370	14-1530
16	12-1480	12-1670	12-1860	14-30	14-225	14-400	14-580	14-750
17	12-1090	12-1310	12-1530	12-1710	12-1935	14-130	14-330	14-530
18	10-610	10-780	10-950	10-1080	10-1245	10-1400	10-1550	12-80
19	10-265	10-435	10-590	10-730	10-900	10-1040	10-1190	10-1430
20	8-1160	8-1315	8-1460	8-1600	8-1760	8-1910	10-65	10-215
21	10-225	10-380	10-530	10-675	10-850	10-1015	10-1180	10-1345
22	10-435	10-540	10-665	10-790	10-940	10-1080	10-1230	10-1355
23	8-1910	10-20	10-130	10-255	10-405	10-540	10-690	10-820
24	10-10	10-115	10-230	10-350	10-500	10-640	10-790	10-940
25	10-1155	10-1260	10-1380	10-1480	10-1630	10-1760	10-1910	12-110
26	8-1330	8-1440	8-1575	8-1700	8-1850	10-005	10-150	10-265
27	8-1185	8-1320	8-1460	8-1590	8-1755	8-1900	10-55	10-1170
28	10-670	10-820	10-965	10-1090	10-1240	10-1390	10-1540	12-260

Strain readings in micro inch per inch

LEAD IN TONNAGE

1944

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of Zero Nominal Deflection
 Back Face

LOAD IN POUNDS

GAGE NUMBER	0	15000	30000	45000	60000	75000	90000	105000
1	8-870	8-950	8-1035	8-1090	8-1180	8-1230	8-1360	8-1370
2	10-1265	10-1385	10-1505	10-1590	10-1710	10-1815	10-1930	10-1970
3	10-1630	10-1800	10-1945	12-70	12-220	12-350	12-485	12-620
A	10-1870	10-1980	12-90	12-165	12-260	12-335	12-420	12-580
B	10-450	10-430	10-415	10-390	10-380	10-355	10-325	10-280
C	12-000	10-1980	10-1965	10-1935	10-1920	10-1895	10-1855	10-1815
D	10-1800	10-1905	12-0000	12-75	12-170	12-245	12-330	12-490
4	12-340	12-510	12-680	12-825	12-985	12-1130	12-1285	12-1415
5	10-1130	10-1310	10-1480	10-1630	10-1845	10-1950	12-105	12-230
6	10-1800	10-1980	12-170	12-340	12-530	12-705	12-875	12-1090
7	10-835	10-975	10-1130	10-1280	10-1445	10-1600	10-1760	10-1930
8	12-420	12-525	12-670	12-810	12-970	12-1120	12-1270	12-1445
9	8-1410	8-1525	8-1650	8-1790	8-1940	10-100	10-245	10-380
10	10-1650	10-1760	10-1890	12-30	12-195	12-345	12-490	12-670
11	10-1770	10-1900	12-40	12-185	12-340	12-500	12-655	12-825
12	10-1710	10-1850	12-15	12-170	12-340	12-500	12-665	12-930
13	10-1765	10-1930	12-90	12-250	12-415	12-570	12-735	12-890
14	12-180	12-330	12-470	12-610	12-745	12-880	12-1020	12-1145
E	10-540	10-630	10-690	10-750	10-820	10-880	10-940	10-1030
F	10-1475	10-1475	10-1440	10-1415	10-1390	10-1360	10-1320	10-1280
G	10-1460	10-1470	10-1455	10-1420	10-1415	10-1400	10-1370	10-1335
H	12-100	12-200	12-280	12-340	12-425	12-490	12-565	12-650
15	10-1390	10-1530	10-1650	10-1765	10-1890	12-10	12-145	12-280
16	12-465	12-505	12-520	12-550	12-595	12-630	12-680	12-740
17	10-1315	10-1410	10-1490	10-1570	10-1655	10-1750	10-1845	10-1940
18	12-010	12-200	12-360	12-515	12-670	12-820	12-980	12-1640
19	10-1305	10-1490	10-1660	10-1800	10-1965	12-115	12-270	12-560
20	10-1460	10-1630	10-1790	10-1950	12-110	12-260	12-415	12-545
21	12-370	12-520	12-660	12-810	12-970	12-1110	12-1260	12-1375
22	10-1730	10-1890	12-55	12-225	12-410	12-575	12-750	12-880
23	10-1140	10-1285	10-1430	10-1590	10-1770	10-1935	12-110	12-240
24	10-1400	10-1550	10-1690	10-1850	12-30	12-190	12-370	12-545
25	10-530	10-670	10-815	10-965	10-1125	10-1300	10-1465	10-1735
26	10-1980	12-120	12-250	12-390	12-535	12-690	12-840	12-1010
27	10-1710	10-1835	10-1950	12-90	12-220	12-355	12-495	12-1395
28	12-270	12-405	12-520	12-650	12-785	12-915	12-1050	12-1785

Strain readings in micro-inch per inch

(continued)
 TABLE
 of
 Place of Birth of Persons
 in the Army

1918

Serial	First Name	Last Name	Place of Birth
1	John	Smith	10-1-1880
2	James	Johnson	10-1-1885
3	Robert	Williams	10-1-1890
4	Charles	Brown	10-1-1895
5	Thomas	Miller	10-1-1900
6	William	Moore	10-1-1905
7	George	White	10-1-1910
8	Richard	Clark	10-1-1915
9	Joseph	Green	10-1-1920
10	Samuel	Adams	10-1-1925
11	David	Nelson	10-1-1930
12	Michael	Phillips	10-1-1935
13	Christopher	Evans	10-1-1940
14	Matthew	Scott	10-1-1945
15	Anthony	Walker	10-1-1950
16	Donald	Young	10-1-1955
17	Edward	Allen	10-1-1960
18	Frederick	King	10-1-1965
19	Robert	Wright	10-1-1970
20	William	Gray	10-1-1975
21	Thomas	James	10-1-1980
22	Charles	Wilson	10-1-1985
23	John	Anderson	10-1-1990
24	James	Thompson	10-1-1995
25	Robert	Lee	10-1-2000
26	Charles	Roberts	10-1-2005
27	Thomas	Watts	10-1-2010
28	William	Brooks	10-1-2015
29	George	Hyatt	10-1-2020
30	Richard	Myers	10-1-2025
31	Joseph	Black	10-1-2030
32	Samuel	Reed	10-1-2035
33	David	Cook	10-1-2040
34	Michael	Baker	10-1-2045
35	Christopher	Turner	10-1-2050
36	Matthew	Phillips	10-1-2055
37	Anthony	Evans	10-1-2060
38	Donald	Scott	10-1-2065
39	Edward	Walker	10-1-2070
40	Frederick	King	10-1-2075
41	Robert	Wright	10-1-2080
42	William	Gray	10-1-2085
43	Thomas	James	10-1-2090
44	Charles	Wilson	10-1-2095
45	John	Anderson	10-1-2100
46	James	Thompson	10-1-2105
47	Robert	Lee	10-1-2110
48	Charles	Roberts	10-1-2115
49	Thomas	Watts	10-1-2120
50	William	Brooks	10-1-2125
51	George	Hyatt	10-1-2130
52	Richard	Myers	10-1-2135
53	Joseph	Black	10-1-2140
54	Samuel	Reed	10-1-2145
55	David	Cook	10-1-2150
56	Michael	Baker	10-1-2155
57	Christopher	Turner	10-1-2160
58	Matthew	Phillips	10-1-2165
59	Anthony	Evans	10-1-2170
60	Donald	Scott	10-1-2175
61	Edward	Walker	10-1-2180
62	Frederick	King	10-1-2185
63	Robert	Wright	10-1-2190
64	William	Gray	10-1-2195
65	Thomas	James	10-1-2200
66	Charles	Wilson	10-1-2205
67	John	Anderson	10-1-2210
68	James	Thompson	10-1-2215
69	Robert	Lee	10-1-2220
70	Charles	Roberts	10-1-2225
71	Thomas	Watts	10-1-2230
72	William	Brooks	10-1-2235
73	George	Hyatt	10-1-2240
74	Richard	Myers	10-1-2245
75	Joseph	Black	10-1-2250
76	Samuel	Reed	10-1-2255
77	David	Cook	10-1-2260
78	Michael	Baker	10-1-2265
79	Christopher	Turner	10-1-2270
80	Matthew	Phillips	10-1-2275
81	Anthony	Evans	10-1-2280
82	Donald	Scott	10-1-2285
83	Edward	Walker	10-1-2290
84	Frederick	King	10-1-2295
85	Robert	Wright	10-1-2300
86	William	Gray	10-1-2305
87	Thomas	James	10-1-2310
88	Charles	Wilson	10-1-2315
89	John	Anderson	10-1-2320
90	James	Thompson	10-1-2325
91	Robert	Lee	10-1-2330
92	Charles	Roberts	10-1-2335
93	Thomas	Watts	10-1-2340
94	William	Brooks	10-1-2345
95	George	Hyatt	10-1-2350
96	Richard	Myers	10-1-2355
97	Joseph	Black	10-1-2360
98	Samuel	Reed	10-1-2365
99	David	Cook	10-1-2370
100	Michael	Baker	10-1-2375

Serial numbers in above list per last

TABLE III(continued)
DATA SHEET
 Strain -Load Readings
 Plate of 1/8" Nominal Deflection
 Front Face

LOAD IN POUNDS

GAGE NUMBER	0	20000	35000	50000	65000	80000	95000
1	12-1930	14-600	14-815	14-1000	14-1190	14-1350	14-1530
2	12-1870	14-525	14-750	14-940	14-1130	14-1290	14-1470
3	14-585	14-1175	14-1380	14-1565	14-1755	14-1930	16-100
4	12-980	12-1560	12-1765	12-1940	14-130	14-300	14-450
5	14-1230	14-1865	16-90	16-295	16-450	16-700	16-865
6	14-105	14-790	14-1050	14-1280	14-1530	14-1770	14-1980
7	14-830	14-1525	14-1800	16-50	16-310	16-545	16-760
8	12-640	12-1310	12-1570	12-1810	14-70	14-300	14-510
9	14-590	14-1190	14-1450	14-1680	14-1940	16-180	16-400
10	12-810	12-1415	12-1690	12-1940	14-210	14-455	14-685
11	14-630	14-1240	14-1510	14-1750	16-10	16-240	16-510
12	14-415	14-995	14-1260	14-1485	14-1730	14-1940	16-175
13	12-720	12-1215	12-1415	12-1595	12-1790	12-1965	14-140
14	12-1930	14-420	14-615	14-780	14-955	14-1120	14-1275
15	12-1740	14-210	14-415	14-580	14-765	14-920	14-1080
16	12-80	12-570	12-780	12-960	12-1150	12-1310	12-1490
17	12-540	12-990	12-1220	12-1390	12-1580	12-1750	12-1945
18	12-1610	14-80	14-300	14-485	14-680	14-850	14-1015
19	12-665	12-1060	12-1255	12-1415	12-1600	12-1770	12-1945
20	12-1060	12-1420	12-1605	12-1790	12-1980	14-170	14-370
21	12-760	12-1115	12-1300	12-1475	12-1660	12-1850	14-70
22	12-1875	14-260	14-445	14-620	14-810	14-1000	14-1210
23	12-510	12-980	12-1150	12-1345	12-1550	12-1760	14-10
24	12-1840	14-280	14-480	14-680	14-890	14-1100	14-1355
25	14-1350	14-1755	14-1925	16-100	16-290	16-475	16-670
26	12-1900	14-340	14-505	14-670	14-850	14-1030	14-1210
27	14-1040	14-1470	14-1675	14-1865	16-60	16-240	16-440
28	12-1080	12-1510	12-1715	12-1890	14-80	14-250	14-430

Strain readings in micro-inch per inch

(continued) III TABLE
TABLE III
TABLE III
TABLE III

WILSON, JR. & GALT

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	
15-1000	15-1010	15-1020	15-1030	15-1040	15-1050	15-1060	15-1070	15-1080	15-1090	15-1100	15-1110	15-1120	15-1130	15-1140	15-1150	15-1160	15-1170	15-1180	15-1190	15-1200	15-1210	15-1220	15-1230	15-1240	15-1250	15-1260	15-1270	15-1280	15-1290	15-1300	15-1310	15-1320	15-1330	15-1340	15-1350	15-1360	15-1370	15-1380	15-1390	15-1400	15-1410	15-1420	15-1430	15-1440	15-1450	15-1460	15-1470	15-1480	15-1490	15-1500	15-1510	15-1520	15-1530	15-1540	15-1550	15-1560	15-1570	15-1580	15-1590	15-1600	15-1610	15-1620	15-1630	15-1640	15-1650	15-1660	15-1670	15-1680	15-1690	15-1700	15-1710	15-1720	15-1730	15-1740	15-1750	15-1760	15-1770	15-1780	15-1790	15-1800	15-1810	15-1820	15-1830	15-1840	15-1850	15-1860	15-1870	15-1880	15-1890	15-1900	15-1910	15-1920	15-1930	15-1940	15-1950	15-1960	15-1970	15-1980	15-1990	16-0000
16-0000	16-0010	16-0020	16-0030	16-0040	16-0050	16-0060	16-0070	16-0080	16-0090	16-0100	16-0110	16-0120	16-0130	16-0140	16-0150	16-0160	16-0170	16-0180	16-0190	16-0200	16-0210	16-0220	16-0230	16-0240	16-0250	16-0260	16-0270	16-0280	16-0290	16-0300	16-0310	16-0320	16-0330	16-0340	16-0350	16-0360	16-0370	16-0380	16-0390	16-0400	16-0410	16-0420	16-0430	16-0440	16-0450	16-0460	16-0470	16-0480	16-0490	16-0500	16-0510	16-0520	16-0530	16-0540	16-0550	16-0560	16-0570	16-0580	16-0590	16-0600	16-0610	16-0620	16-0630	16-0640	16-0650	16-0660	16-0670	16-0680	16-0690	16-0700	16-0710	16-0720	16-0730	16-0740	16-0750	16-0760	16-0770	16-0780	16-0790	16-0800	16-0810	16-0820	16-0830	16-0840	16-0850	16-0860	16-0870	16-0880	16-0890	16-0900	16-0910	16-0920	16-0930	16-0940	16-0950	16-0960	16-0970	16-0980	16-0990	17-0000
17-0000	17-0010	17-0020	17-0030	17-0040	17-0050	17-0060	17-0070	17-0080	17-0090	17-0100	17-0110	17-0120	17-0130	17-0140	17-0150	17-0160	17-0170	17-0180	17-0190	17-0200	17-0210	17-0220	17-0230	17-0240	17-0250	17-0260	17-0270	17-0280	17-0290	17-0300	17-0310	17-0320	17-0330	17-0340	17-0350	17-0360	17-0370	17-0380	17-0390	17-0400	17-0410	17-0420	17-0430	17-0440	17-0450	17-0460	17-0470	17-0480	17-0490	17-0500	17-0510	17-0520	17-0530	17-0540	17-0550	17-0560	17-0570	17-0580	17-0590	17-0600	17-0610	17-0620	17-0630	17-0640	17-0650	17-0660	17-0670	17-0680	17-0690	17-0700	17-0710	17-0720	17-0730	17-0740	17-0750	17-0760	17-0770	17-0780	17-0790	17-0800	17-0810	17-0820	17-0830	17-0840	17-0850	17-0860	17-0870	17-0880	17-0890	17-0900	17-0910	17-0920	17-0930	17-0940	17-0950	17-0960	17-0970	17-0980	17-0990	18-0000
18-0000	18-0010	18-0020	18-0030	18-0040	18-0050	18-0060	18-0070	18-0080	18-0090	18-0100	18-0110	18-0120	18-0130	18-0140	18-0150	18-0160	18-0170	18-0180	18-0190	18-0200	18-0210	18-0220	18-0230	18-0240	18-0250	18-0260	18-0270	18-0280	18-0290	18-0300	18-0310	18-0320	18-0330	18-0340	18-0350	18-0360	18-0370	18-0380	18-0390	18-0400	18-0410	18-0420	18-0430	18-0440	18-0450	18-0460	18-0470	18-0480	18-0490	18-0500	18-0510	18-0520	18-0530	18-0540	18-0550	18-0560	18-0570	18-0580	18-0590	18-0600	18-0610	18-0620	18-0630	18-0640	18-0650	18-0660	18-0670	18-0680	18-0690	18-0700	18-0710	18-0720	18-0730	18-0740	18-0750	18-0760	18-0770	18-0780	18-0790	18-0800	18-0810	18-0820	18-0830	18-0840	18-0850	18-0860	18-0870	18-0880	18-0890	18-0900	18-0910	18-0920	18-0930	18-0940	18-0950	18-0960	18-0970	18-0980	18-0990	19-0000
19-0000	19-0010	19-0020	19-0030	19-0040	19-0050	19-0060	19-0070	19-0080	19-0090	19-0100	19-0110	19-0120	19-0130	19-0140	19-0150	19-0160	19-0170	19-0180	19-0190	19-0200	19-0210	19-0220	19-0230	19-0240	19-0250	19-0260	19-0270	19-0280	19-0290	19-0300	19-0310	19-0320	19-0330	19-0340	19-0350	19-0360	19-0370	19-0380	19-0390	19-0400	19-0410	19-0420	19-0430	19-0440	19-0450	19-0460	19-0470	19-0480	19-0490	19-0500	19-0510	19-0520	19-0530	19-0540	19-0550	19-0560	19-0570	19-0580	19-0590	19-0600	19-0610	19-0620	19-0630	19-0640	19-0650	19-0660	19-0670	19-0680	19-0690	19-0700	19-0710	19-0720	19-0730	19-0740	19-0750	19-0760	19-0770	19-0780	19-0790	19-0800	19-0810	19-0820	19-0830	19-0840	19-0850	19-0860	19-0870	19-0880	19-0890	19-0900	19-0910	19-0920	19-0930	19-0940	19-0950	19-0960	19-0970	19-0980	19-0990	20-0000
20-0000	20-0010	20-0020	20-0030	20-0040	20-0050	20-0060	20-0070	20-0080	20-0090	20-0100	20-0110	20-0120	20-0130	20-0140	20-0150	20-0160	20-0170	20-0180	20-0190	20-0200	20-0210	20-0220	20-0230	20-0240	20-0250	20-0260	20-0270	20-0280	20-0290	20-0300	20-0310	20-0320	20-0330	20-0340	20-0350	20-0360	20-0370	20-0380	20-0390	20-0400	20-0410	20-0420	20-0430	20-0440	20-0450	20-0460	20-0470	20-0480	20-0490	20-0500	20-0510	20-0520	20-0530	20-0540	20-0550	20-0560	20-0570	20-0580	20-0590	20-0600	20-0610	20-0620	20-0630	20-0640	20-0650	20-0660	20-0670	20-0680	20-0690	20-0700	20-0710	20-0720	20-0730	20-0740	20-0750	20-0760	20-0770	20-0780	20-0790	20-0800	20-0810	20-0820	20-0830	20-0840	20-0850	20-0860	20-0870	20-0880	20-0890	20-0900	20-0910	20-0920	20-0930	20-0940	20-0950	20-0960	20-0970	20-0980	20-0990	21-0000
21-0000	21-0010	21-0020	21-0030	21-0040	21-0050	21-0060	21-0070	21-0080	21-0090	21-0100	21-0110	21-0120	21-0130	21-0140	21-0150	21-0160	21-0170	21-0180	21-0190	21-0200	21-0210	21-0220	21-0230	21-0240	21-0250	21-0260	21-0270	21-0280	21-0290	21-0300	21-0310	21-0320	21-0330	21-0340	21-0350	21-0360	21-0370	21-0380	21-0390	21-0400	21-0410	21-0420	21-0430	21-0440	21-0450	21-0460	21-0470	21-0480	21-0490	21-0500	21-0510	21-0520	21-0530	21-0540	21-0550	21-0560	21-0570	21-0580	21-0590	21-0600	21-0610	21-0620	21-0630	21-0640	21-0650	21-0660	21-0670	21-0680	21-0690	21-0700	21-0710	21-0720	21-0730	21-0740	21-0750	21-0760	21-0770	21-0780	21-0790	21-0800	21-0810	21-0820	21-0830	21-0840	21-0850	21-0860	21-0870	21-0880	21-0890	21-0900	21-0910	21-0920	21-0930	21-0940	21-0950	21-0960	21-0970	21-0980	21-0990	22-0000
22-0000	22-0010	22-0020	22-0030	22-0040	22-0050	22-0060	22-0070	22-0080	22-0090	22-0100	22-0110	22-0120	22-0130	22-0140	22-0150	22-0160	22-0170	22-0180	22-0190	22-0200	22-0210	22-0220	22-0230	22-0240	22-0250	22-0260	22-0270	22-0280	22-0290	22-0300	22-0310	22-0320	22-0330	22-0340	22-0350	22-0360	22-0370	22-0380	22-0390	22-0400	22-0410	22-0420	22-0430	22-0440	22-0450	22-0460	22-0470	22-0480	22-0490	22-0500	22-0510	22-0520	22-0530	22-0540	22-0550	22-0560	22-0570	22-0580	22-0590	22-0600	22-0610	22-0620	22-0630	22-0640	22-0650	22-0660	22-0670	22-0680	22-0690	22-0700	22-0710	22-0720	22-0730	22-0740	22-0750	22-0760	22-0770	22-0780	22-0790	22-0800	22-0810	22-0820	22-0830	22-0840	22-0850	22-0860	22-0870	22-0880	22-0890	22-0900	22-0910	22-0920	22-0930	22-0940	22-0950	22-0960	22-0970	22-0980	22-0990	23-0000
23-0000	23-0010	23-0020	23-0030	23-0040	23-0050	23-0060	23-0070	23-0080	23-0090	23-0100	23-0110	23-0120	23-0130	23-0140	23-0150	23-0160	23-0170	23-0180	23-0190	23-0200	23-0210	23-0220	23-0230	23-0240	23-0250	23-0260	23-0270	23-0280	23-0290	23-0300	23-0310	23-0320	23-0330	23-0340	23-0350	23-0360	23-0370	23-0380	23-0390	23-0400	23-0410	23-0420	23-0430	23-0440	23-0450	23-0460	23-0470	23-0480	23-0490	23-0500	23-0510	23-0520	23-0530	23-0540	23-0550	23-0560	23-0570	23-0580	23-0590	23-0600	23-0610	23-0620	23-0630	23-0640	23-0650	23-0660	23-0670	23-0680	23-0690	23-0700	23-0710	23-0720	23-0730	23-0740	23-0750	23-0760	23-0770	23-0780	23-0790	23-0800	23-0810	23-0820	23-0830	23-0840	23-0850	23-0860	23-0870	23-0880	23-0890	23-0900	23-0910	23-0920	23-0930	23-0940	23-0950	23-0960	23-0970	23-0980	23-0990	24-0000
24-0000	24-0010	24-0020	24-0030	24-0040	24-0050	24-0060	24-0070	24-0080	24-0090	24-0100	24-0110	24-0120	24-0130	24-0140	24-0150	24-0160	24-0170	24-0180	24-0190	24-0200	24-0210	24-0220	24-0230	24-0240	24-0250	24-0260	24-0270	24-0280	24-0290	24-0300	24-0310	24-0320	24-0330	24-0340	24-0350	24-0360	24-0370	24-0380	24-0390	24-0400	24-0410	24-0420	24-0430	24-0440	24-0450	24-0460	24-0470	24-0480	24-0490	24-0500	24-0510	24-0520	24-0530	24-0540	24-0550	24-0560	24-0570	24-0580	24-0590	24-0600	24-0610</																																							

What was the result of the investigation?

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 1/8" Nominal Deflection
 Back Face

LOAD IN POUNDS

<u>PAGE</u>							
<u>NUMBER</u>	<u>0</u>	<u>2000</u>	<u>35000</u>	<u>50000</u>	<u>65000</u>	<u>80000</u>	<u>95000</u>
1	14-900	14-1210	14-1375	14-1525	14-1680	14-1820	14-1975
2	14-530	14-875	14-1060	14-1220	14-1380	14-1535	14-1700
3	14-610	14-975	14-1170	14-1340	14-1510	14-1665	14-1840
A	14-1800	16-60	16-165	16-265	16-360	16-440	16-515
B	14-720	14-830	14-815	14-800	14-790	14-760	14-710
C	16-20	16-170	16-170	16-165	16-170	16-160	16-120
D	14-980	14-1240	14-1350	14-1450	14-1550	14-1650	14-1730
4	14-1310	14-1660	14-1850	16-25	16-205	16-370	16-540
5	14-970	14-1190	14-1280	14-1370	14-1490	14-1590	14-1690
6	16-360	16-510	16-560	16-610	16-690	16-780	16-870
7	14-1680	14-1805	14-1850	14-1910	16-0	16-105	16-210
8	16-1110	16-1220	16-1260	16-1320	16-1405	16-1510	16-1630
9	16-500	16-580	16-590	16-610	16-680	16-760	16-860
10	14-1045	14-1110	14-1115	14-1140	14-1200	14-1275	14-1350
11	14-1920	16-50	16-80	16-135	16-215	16-300	16-410
12	14-620	14-780	14-830	14-890	14-980	14-1070	14-1170
13	14-1810	16-50	16-155	16-255	16-370	16-480	16-590
14	16-135	16-490	16-670	16-820	16-980	16-1125	16-1270
E	14-1900	16-170	16-280	16-370	16-475	16-560	16-630
F	14-1730	14-1850	14-1870	14-1875	14-1885	14-1890	14-1850
G	14-1530	14-1635	14-1640	14-1640	14-1640	14-1630	14-1510
H	14-505	14-755	14-855	14-950	14-1041	14-1120	14-1190
15	14-890	14-1230	14-1410	14-1575	14-1740	14-1890	16-50
16	14-1190	14-1530	14-1705	14-1850	16-10	16-150	16-300
17	14-1870	16-175	16-320	16-450	16-585	16-700	16-840
18	14-1480	14-1800	14-1965	16-115	16-265	16-400	16-550
19	12-1690	12-1890	12-1970	14-60	14-140	14-225	14-285
20	14-1390	14-1610	14-1705	14-1790	14-1880	14-1970	16-35
21	--	--	--	--	--	--	--
22	14-785	14-1030	14-1130	14-1235	14-1355	14-1470	14-1585
23	14-1130	14-1315	14-1395	14-1470	14-1560	14-1650	14-1730
24	16-145	16-315	16-410	16-480	16-560	16-645	16-715
25	14-1590	14-1840	14-1980	16-100	16-230	16-360	16-475
26	14-1140	14-1390	14-1490	14-1585	14-1685	14-1785	14-1875
27	14-1950	16-175	16-280	16-365	16-455	16-540	16-630
28	14-110	14-1400	14-1590	14-1745	14-1900	16-40	16-200

Table 171 (continued)
 Days 1975
 (Days 1975)
 Days of 1975 (1975)
 Days 1975

Days 1975

1975	1975	1975	1975	1975	1975	1975	1975
1	1-1-75	1-1-75	1-1-75	1-1-75	1-1-75	1-1-75	1-1-75
2	1-2-75	1-2-75	1-2-75	1-2-75	1-2-75	1-2-75	1-2-75
3	1-3-75	1-3-75	1-3-75	1-3-75	1-3-75	1-3-75	1-3-75
4	1-4-75	1-4-75	1-4-75	1-4-75	1-4-75	1-4-75	1-4-75
5	1-5-75	1-5-75	1-5-75	1-5-75	1-5-75	1-5-75	1-5-75
6	1-6-75	1-6-75	1-6-75	1-6-75	1-6-75	1-6-75	1-6-75
7	1-7-75	1-7-75	1-7-75	1-7-75	1-7-75	1-7-75	1-7-75
8	1-8-75	1-8-75	1-8-75	1-8-75	1-8-75	1-8-75	1-8-75
9	1-9-75	1-9-75	1-9-75	1-9-75	1-9-75	1-9-75	1-9-75
10	1-10-75	1-10-75	1-10-75	1-10-75	1-10-75	1-10-75	1-10-75
11	1-11-75	1-11-75	1-11-75	1-11-75	1-11-75	1-11-75	1-11-75
12	1-12-75	1-12-75	1-12-75	1-12-75	1-12-75	1-12-75	1-12-75
13	1-13-75	1-13-75	1-13-75	1-13-75	1-13-75	1-13-75	1-13-75
14	1-14-75	1-14-75	1-14-75	1-14-75	1-14-75	1-14-75	1-14-75
15	1-15-75	1-15-75	1-15-75	1-15-75	1-15-75	1-15-75	1-15-75
16	1-16-75	1-16-75	1-16-75	1-16-75	1-16-75	1-16-75	1-16-75
17	1-17-75	1-17-75	1-17-75	1-17-75	1-17-75	1-17-75	1-17-75
18	1-18-75	1-18-75	1-18-75	1-18-75	1-18-75	1-18-75	1-18-75
19	1-19-75	1-19-75	1-19-75	1-19-75	1-19-75	1-19-75	1-19-75
20	1-20-75	1-20-75	1-20-75	1-20-75	1-20-75	1-20-75	1-20-75
21	1-21-75	1-21-75	1-21-75	1-21-75	1-21-75	1-21-75	1-21-75
22	1-22-75	1-22-75	1-22-75	1-22-75	1-22-75	1-22-75	1-22-75
23	1-23-75	1-23-75	1-23-75	1-23-75	1-23-75	1-23-75	1-23-75
24	1-24-75	1-24-75	1-24-75	1-24-75	1-24-75	1-24-75	1-24-75
25	1-25-75	1-25-75	1-25-75	1-25-75	1-25-75	1-25-75	1-25-75
26	1-26-75	1-26-75	1-26-75	1-26-75	1-26-75	1-26-75	1-26-75
27	1-27-75	1-27-75	1-27-75	1-27-75	1-27-75	1-27-75	1-27-75
28	1-28-75	1-28-75	1-28-75	1-28-75	1-28-75	1-28-75	1-28-75
29	1-29-75	1-29-75	1-29-75	1-29-75	1-29-75	1-29-75	1-29-75
30	1-30-75	1-30-75	1-30-75	1-30-75	1-30-75	1-30-75	1-30-75
31	1-31-75	1-31-75	1-31-75	1-31-75	1-31-75	1-31-75	1-31-75

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 3/16" Nominal Deflection
 Front Face

LOAD IN POUNDS

GAGE NUMBER	0	15000	30000	45000	60000	75000	90000	105000
1	8-1430	8-1820	8-1950	10-170	10-350	10-500	10-645	10-880
2	8-170	8-580	8-715	8-960	8-1150	8-1300	8-1465	8-1500
3	8-570	8-1000	8-1155	8-1400	8-1600	8-1775	8-1955	8-1975
4	6-1185	6-1640	6-1815	8-80	8-300	8-485	8-560	8-1945
5	6-1685	8-175	8-380	8-670	8-915	8-1125	8-1370	8-1420
6	8-335	8-900	8-1200	8-1570	8-1890	10-180	10-470	10-335
7	8-540	8-1140	8-1460	8-1850	10-200	10-510	10-755	10-720
8	8-260	8-840	8-1130	8-1490	8-1795	10-85	10-290	10-220
9	8-140	8-730	8-1025	8-1370	8-1670	8-1950	10-110	10-70
10	6-1980	8-645	8-990	8-1385	8-1720	10-50	10-205	10-650
11	6-860	6-1485	6-1820	8-185	8-505	8-800	8-1025	8-840
12	8-120	8-745	8-1050	8-1405	8-1700	8-1995	10-270	10-70
13	8-265	8-835	8-1095	8-1400	8-1655	8-1900	10-150	10-550
14	6-1200	6-1690	6-1895	8-145	8-370	8-560	8-770	10-310
15	8-720	8-1175	8-1355	8-1570	8-1760	8-1940	10-115	10-900
16	8-970	8-1425	8-1600	8-1810	8-1990	10-150	10-340	10-660
17	8-100	8-520	8-690	8-880	8-1050	8-1190	8-1415	8-1530
18	8-190	8-600	8-805	8-1055	8-1260	8-1470	8-1700	10-1100
19	6-1520	6-1880	8-20	8-215	8-370	8-540	8-760	10-1380
20	8-1600	8-1870	8-1905	10-000	10-100	10-200	10-320	10-470
21	6-1690	6-1955	6-1980	8-70	8-160	8-260	8-380	8-565
22	8-1035	8-1330	8-1380	8-1510	8-1625	8-1770	8-960	10-380
23	8-540	8-810	8-885	8-1000	8-1110	8-1250	8-1415	8-1960
24	8-1050	8-1335	8-1390	8-1515	8-1640	8-1780	8-1930	10-420
25	8-1240	8-1490	8-1510	8-1585	8-1675	8-1750	8-1930	10-220
26	8-1180	8-1510	8-1590	8-1735	8-1860	8-1980	10-260	10-310
27	8-1100	8-1535	8-1730	8-1950	10-140	10-330	10-470	10-1385
28	8-920	8-1265	8-1565	8-1795	8-1980	10-165	10-330	10-500

Strain readings in micro-inch per inch.

TABLE 1
 SUMMARY OF DATA
 FOR THE YEAR 1960

TABLE 1

1960	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612	1611	1610	1609	1608	1607	1606	1605	1604	1603	1602	1601	1600	1599	1598	1597	1596	1595	1594	1593	1592	1591	1590	1589	1588	1587	1586	1585	1584	1583	1582	1581	1580	1579	1578	1577	1576	1575	1574	1573	1572	1571	1570	1569	1568	1567	1566	1565	1564	1563	1562	1561	1560	1559	1558	1557	1556	1555	1554	1553	1552	1551	1550	1549	1548	1547	1546	1545	1544	1543	1542	1541	1540	1539	1538	1537	1536	1535	1534	1533	1532	1531	1530	1529	1528	1527	1526	1525	1524	1523	1522	1521	1520	1519	1518	1517	1516	1515	1514	1513	1512	1511	1510	1509	1508	1507	1506	1505	1504	1503	1502	1501	1500	1499	1498	1497	1496	1495	1494	1493	1492	1491	1490	1489	1488	1487	1486	1485	1484	1483	1482	1481	1480	1479	1478	1477	1476	1475	1474	1473	1472	1471	1470	1469	1468	1467	1466	1465	1464	1463	1462	1461	1460	1459	1458	1457	1456	1455	1454	1453	1452	1451	1450	1449	1448	1447	1446	1445	1444	1443	1442	1441	1440	1439	1438	1437	1436	1435	1434	1433	1432	1431	1430	1429	1428	1427	1426	1425	1424	1423	1422	1421	1420	1419	1418	1417	1416	1415	1414	1413	1412	1411	1410	1409	1408	1407	1406	1405	1404	1403	1402	1401	1400	1399	1398	1397	1396	1395	1394	1393	1392	1391	1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	1377	1376	1375	1374	1373	1372	1371	1370	1369	1368	1367	1366	1365	1364	1363	1362	1361	1360	1359	1358	1357	1356	1355	1354	1353	1352	1351	1350	1349	1348	1347	1346	1345	1344	1343	1342	1341	1340	1339	1338	1337	1336	1335	1334	1333	1332	1331	1330	1329	1328	1327	1326	1325	1324	1323	1322	1321	1320	1319	1318	1317	1316	1315	1314	1313	1312	1311	1310	1309	1308	1307	1306	1305	1304	1303	1302	1301	1300	1299	1298	1297	1296	1295	1294	1293	1292	1291	1290	1289	1288	1287	1286	1285	1284	1283	1282	1281	1280	1279	1278	1277	1276	1275	1274	1273	1272	1271	1270	1269	1268	1267	1266	1265	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951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TABLE III (continued)
DATA SHEET
Strain-Load Readings
Plate of 3/16" Nominal Deflection
Back Face

LOAD IN POUNDS

CAGE NUMBER	0	15000	30000	45000	60000	75000	90000	105000
1	8-420	8-855	8-1040	8-1265	8-1450	8-1630	8-1800	10-30
2	10-1425	10-1810	10-1985	12-225	12-410	12-600	12-770	12-800
3	8-1545	8-1915	10-100	10-310	10-495	10-670	10-855	10-920
A	12-445	12-730	12-820	12-930	12-1020	12-1110	12-1120	12-1660
B	12-085	12-270	12-225	12-200	12-160	12-140	12-70	10-1900
C	10-1370	10-1585	10-1570	10-1570	10-1570	10-1550	10-1525	10-1430
D	10-1735	12-45	12-140	12-290	12-400	12-505	12-625	12-1115
4	10-1910	12-780	12-450	12-650	12-825	12-995	12-1190	12-425
5	8-720	8-950	8-985	8-1025	8-1090	8-1140	8-1240	8-1760
6	8-860	8-1010	8-975	8-945	8-950	8-970	8-995	8-1550
7	8-1240	8-1320	8-1230	8-1160	8-1120	8-1090	8-1140	8-1685
8	8-380	8-450	8-350	8-290	8-255	8-270	8-300	8-650
9	6-1750	6-1820	6-1760	6-1710	6-1680	6-1705	6-1760	8-130
10	8-1080	8-1200	8-1130	8-1100	8-1080	8-1110	8-1220	8-1900
11	8-560	8-670	8-590	8-535	8-520	8-540	8-590	8-1210
12	8-490	8-620	8-600	8-595	8-600	8-640	8-710	8-1365
13	8-100	8-350	8-420	8-495	8-570	8-660	8-755	8-1520
14	8-750	8-1140	8-1330	8-1510	8-1660	8-1830	10-240	10-1230
E	10-1935	12-270	12-400	12-525	12-615	12-700	12-850	12-1305
F	10-875	10-1075	10-1070	10-1080	10-1075	10-1040	10-1015	10-945
G	12-175	12-345	12-300	12-260	12-230	12-175	12-105	10-1965
H	12-115	12-430	12-530	12-615	12-695	12-720	12-875	12-1370
15	8-1440	8-1865	10-70	10-260	10-425	10-590	10-790	10-1490
16	6-1505	6-1920	8-120	8-310	8-470	8-635	8-810	8-1115
17	8-985	8-1400	8-1635	8-1815	8-1955	10-120	10-300	10-500
18	12-175	12-520	12-700	12-860	12-1010	12-1190	12-1325	14-740
19	10-1250	10-1515	10-1590	10-1670	10-1750	10-1820	10-1870	10-1580
20	12-085	12-410	12-540	12-690	12-830	12-955	12-1060	12-1345
21	12-800	12-1175	12-1350	12-1540	12-1730	12-1900	14-25	14-255
22	12-275	12-600	12-715	12-840	12-990	12-1115	12-1150	12-1390
23	10-960	10-1295	10-1395	10-1550	10-1685	10-1800	10-1845	10-1965
24	12-650	12-1025	12-1200	12-1375	12-1560	12-1720	12-1825	14-215
25	12-000	12-420	12-620	12-840	12-1050	12-1250	12-1350	12-1650
26	10-1425	10-1785	10-1955	12-130	12-310	12-435	12-460	12-655
27	12-310	12-640	12-760	12-885	12-1020	12-1105	12-1125	12-1030
28	8-375	8-740	8-900	8-1060	8-1205	8-1325	8-1430	8-1545

Strain readings in micro-inch per inch.

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 1/4" Nominal Deflection
 Front Face

LOAD IN POUNDS

GAGE NUMBER	0#	10 ^{K#}	20 ^{K#}	30 ^{K#}	40 ^{K#}	50 ^{K#}
1	14-445	14-560	14-670	14-760	14-860	14-955
2	14-1080	14-1210	14-1330	14-1450	14-1565	14-1680
3	16-370	16-510	16-640	16-760	16-880	16-1000
4	16-290	16-450	16-605	16-750	16-890	16-1025
5	16-160	16-380	16-590	16-790	16-980	16-1165
6	14-1795	16-95	16-395	16-640	16-890	16-1125
7	14-660	14-950	14-1230	14-1480	14-1720	14-1950
8	14-1290	14-1555	14-1815	16-55	16-280	16-510
9	14-1620	14-1915	16-210	16-470	16-720	16-970
10	14-1050	14-1330	14-1610	14-1875	16-120	16-365
11	14-1525	14-1810	16-100	16-370	16-620	16-875
12	14-590	14-850	14-1110	14-1360	14-1590	14-1820
13	14-1075	14-1285	14-1500	14-1710	14-1895	16-90
14	14-1975	16-140	16-310	16-475	16-625	16-770
15	16-0	16-140	16-280	16-415	16-540	16-665
16	14-1890	16-10	16-130	16-255	16-370	16-485
17	14-890	14-990	14-1100	14-1210	14-1310	14-1410
18	16-60	16-215	16-360	16-500	16-620	16-745
19	16-430	16-560	16-690	16-820	16-930	16-1045
20	14-1280	14-1360	14-1435	14-1510	14-1585	14-1660
21	14-270	14-305	14-340	14-380	14-425	14-470
22	14-1775	14-1810	14-1850	14-1900	14-1940	14-2000
23	14-1475	14-1500	14-1520	14-1560	14-1595	14-1640
24	14-785	14-795	14-805	14-820	14-840	14-870
25	14-1520	14-1505	14-1495	14-1490	14-1490	14-1500
26	14-1205	14-1260	14-1310	14-1365	14-1415	14-1465
27	14-1415	14-1530	14-1640	14-1750	14-1850	14-1940
28	14-1475	14-1605	14-1740	14-1870	14-1985	16-95

Strain readings in micro inch per inch

[illegible]

1994-1995

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 1/4" Nominal Deflection
 Front Face (continued)

LOAD IN POUNDS

GAGE NUMBER	60 K#	70 K#	80 K#	90 K#	100 K#	110 K#
1	14-1050	14-1140	14-1230	14-1325	14-1455	14-1645
2	14-1785	14-1890	14-1990	16-100	16-155	16-110
3	16-1110	16-1220	16-1325	16-1430	16-1500	18-280
4	16-1155	16-1280	16-1405	16-1520	18-30	18-1130
5	16-1345	16-1510	16-1680	16-1840	16-1990	18-345
6	16-1360	16-1575	16-1780	16-1990	18-440	18-1260
7	16-190	16-400	16-610	16-825	16-1215	16-1240
8	16-730	16-940	16-1150	16-1375	16-1485	16-1365
9	16-1215	16-1440	16-1665	16-1915	18-45	18-20
10	16-610	16-830	16-1060	16-1340	16-1445	16-1535
11	16-1130	16-1360	16-1610	16-1930	16-1920	16-1770
12	16-55	16-270	16-490	16-760	16-760	16-920
13	16-280	16-450	16-630	16-820	16-1775	18-1510
14	16-920	16-1055	16-1190	16-1340	18-560	20-30
15	16-790	16-910	16-1025	16-1150	16-1200	16-1300
16	16-600	16-705	16-815	16-925	16-880	16-845
17	14-1510	14-1615	14-1710	14-1810	14-1770	14-1755
18	16-870	16-990	16-1105	16-1220	16-1485	18-800
19	16-1160	16-1270	16-1380	16-1495	16-1880	18-1000
20	14-1730	14-1820	14-1905	16-0	16-345	16-1535
21	14-525	14-590	14-660	14-730	14-905	14-920
22	16-65	16-140	16-225	16-310	16-480	16-1075
23	14-1700	14-1760	14-1840	14-1920	16-225	16-345
24	14-910	14-960	14-1020	14-1090	14-1235	14-1360
25	14-1510	14-1540	14-1575	14-1610	14-1805	14-1935
26	14-1530	14-1590	14-1660	14-1740	14-1985	16-135
27	16-40	16-135	16-235	16-340	16-1290	18-710
28	16-210	16-315	16-430	16-550	16-1240	18-940

Strain readings in micro inch per inch

(continued)
Table 1
 United States
 State of New York
 (continued)

1941-1942

County	1941	1942	1943	1944	1945	1946
1	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
2	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
3	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
4	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
5	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
6	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
7	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
8	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
9	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
10	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
11	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
12	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
13	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
14	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
15	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
16	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
17	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
18	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
19	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
20	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
21	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
22	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
23	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
24	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
25	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
26	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
27	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000
28	10-1000	10-1000	10-1000	10-1000	10-1000	10-1000

Amount received in each year

TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 1/4" Nominal Deflection
 Back Face

GAGE NUMBER	LOAD IN POUNDS					
	0 ^{lb}	10 ^{K^{lb}}	20 ^{K^{lb}}	30 ^{K^{lb}}	40 ^{K^{lb}}	50 ^{K^{lb}}
1B	14-395	14-525	14-655	14-780	14-900	14-1010
2	14-1545	14-1670	14-1790	14-1910	16-25	16-135
3	12-1970	14-100	14-230	14-350	14-470	14-580
A	14-1680	14-1740	14-1800	14-1860	14-1915	14-1970
B	14-1835	14-1785	14-1740	14-1705	14-1665	14-1635
C	14-1025	14-1000	14-980	14-970	14-950	14-940
D	14-1545	14-1615	14-1690	14-1760	14-1825	14-1890
4	14-900	14-1025	14-1155	14-1275	14-1390	14-1505
5	14-1020	14-1020	14-1030	14-1045	14-1060	14-1085
6	14-115	14-10	12-1920	12-1855	12-1800	12-1765
7	14-660	14-550	14-450	14-360	14-300	14-255
8	12-570	12-420	12-280	12-160	12-50	10-1965
9	12-220	12-80	10-1960	10-1250	10-1760	10-1690
10	10-1880	10-1730	10-1590	10-1475	10-1370	10-1280
11	14-740	14-590	14-450	14-330	14-215	14-125
12	14-1725	14-1620	14-1515	14-1420	14-1340	14-1275
13	14-1080	14-1065	14-1050	14-1045	14-1040	14-1040
14	14-845	14-970	14-1100	14-1230	14-1350	14-1470
E	16-125	16-200	16-280	16-360	16-440	16-510
F	14-1440	14-1410	14-1390	14-1370	14-1345	14-1330
G	14-1795	14-1730	14-1670	14-1620	14-1565	14-1525
H	14-1085	14-1135	14-1195	14-1250	14-1305	14-1360
15	14-85	14-215	14-360	14-495	14-630	14-755
16	14-1550	14-1685	14-1835	14-1975	16-115	16-250
17	14-1985	16-120	16-275	16-415	16-550	16-685
18	14-1770	14-1885	16-0	16-110	16-215	16-320
19	14-1335	14-1390	14-1435	14-1485	14-1530	14-1580
20	14-1445	14-1530	14-1610	14-1690	14-1770	14-1850
21	14-1660	14-1770	14-1880	14-1990	16-100	16-210
22	14-1465	14-1545	14-1625	14-1710	14-1790	14-1870
23	14-1315	14-1410	14-1510	14-1605	14-1700	14-1800
24	14-810	14-930	14-1050	14-1170	14-1285	14-1405
25	14-1580	14-1680	14-1790	14-1900	16-10	16-120
26	16-20	16-80	16-150	16-220	16-290	16-360
27	14-1350	14-1410	14-1470	14-1530	14-1585	14-1640
28	14-950	14-1050	14-1155	14-1255	14-1355	14-1455

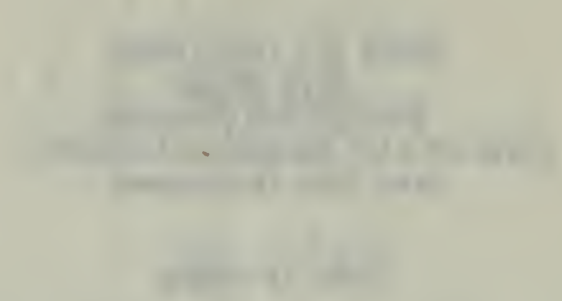
TABLE III (continued)
DATA SHEET
 Strain-Load Readings
 Plate of 1/4" Nominal Deflection
 Back Face (continued)

LOAD IN POUNDS

GAGE NUMBER	60 ^{K#}	70 ^{K#}	80 ^{K#}	90 ^{K#}	100 ^{K#}	110 ^{K#}
1B	14-1130	14-1235	14-1345	14-1450	14-1600	14-1800
2	16-245	16-345	16-450	16-550	16-540	16-580
3	14-690	14-790	14-900	14-1005	14-1055	14-1710
A	16-30	16-85	16-140	16-195	16-480	16-1160
B	14-1610	14-1580	14-1560	14-1530	14-1450	14-1320
C	14-930	14-920	14-915	14-900	14-840	14-730
D	14-1960	16-20	16-90	16-150	16-435	16-1095
4	14-1620	14-1720	14-1830	14-1940	16-460	16-1410
5	14-1115	14-1145	14-1180	14-1225	14-1330	14-1600
6	12-1740	12-1730	12-1730	12-1740	14-15	14-350
7	14-220	14-205	14-200	14-200	14-390	14-885
8	10-1890	10-1830	10-1790	10-1750	12-30	12-465
9	10-1625	10-1585	10-1550	10-1520	10-1725	12-55
10	10-1210	10-1145	10-1100	10-1040	10-1320	10-1770
11	14-40	12-1975	12-1920	12-1850	14-260	14-840
12	14-1220	14-1170	14-1130	14-1090	14-1525	16-90
13	14-1040	14-1050	14-1070	14-1080	14-1470	16-235
14	14-1590	14-1695	14-1810	14-1930	18-15	18-1455
E	16-590	16-655	16-730	16-795	18-130	18-1465
F	14-1310	14-1300	14-1285	14-1260	14-1100	14-1030
G	14-1480	14-1450	14-1410	14-1365	14-1170	14-1070
H	14-1420	14-1470	14-1530	14-1580	16-640	16-1715
15	14-880	14-995	14-1120	14-1235	14-1385	14-1530
16	16-380	16-500	16-620	16-740	16-755	16-795
17	16-815	16-930	16-1055	16-1170	16-1215	16-1260
18	16-420	16-510	16-610	16-705	16-865	16-1830
19	14-1625	14-1670	14-1720	14-1760	14-6785	16-80
20	14-1930	16-10	16-90	16-155	16-240	16-800
21	16-320	16-430	16-540	16-635	16-620	16-925
22	14-1950	16-30	16-105	16-175	16-255	16-420
23	14-1890	14-1990	16-80	16-165	16-125	16-510
24	14-1520	14-1640	14-1760	14-1875	16-255	16-940
25	16-230	16-340	16-455	16-555	16-555	16-985
26	16-430	16-500	16-570	16-640	16-640	16-875
27	14-1690	14-1745	14-1805	14-1860	14-1890	16-590
28	14-1545	14-1640	14-1735	14-1825	16-850	16-1910

APPENDIX B

STRAIN LOAD VALUES



THE JOURNAL

STUDY CASE STUDY

TABLE IV

Strain-Load Values

Plate of Zero Nominal Deflection						Plate of 1/8" Nominal Deflection				
Gage Number	Load in Kips					Load in Kips				
	20	40	60	80	100	20	40	60	80	100
1	285	570	855	1135	1390	250	500	750	1000	1250
1	110	220	325	435	510	200	400	600	800	1000
1	192.5	395	590	785	950	225	450	675	900	1125
2	245	495	740	990	1185	240	480	720	960	1200
2	145	285	430	580	680	210	425	640	850	1065
2	195	390	585	785	932.5	225	452.5	680	905	1132.5
3	220	440	660	880	1095	250	500	755	1005	1260
3	185	370	550	735	920	225	450	670	895	1120
3	202.5	405	605	807.5	1007.5	237.5	475	712.5	950	1190
4	205	410	625	830	1035	250	495	745	990	1240
4	205	410	625	830	1035	235	470	710	945	1180
4	205	410	625	830	1035	242.5	492.5	727.5	967.5	1210
5	200	400	600	800	1000	270	545	815	1090	1360
5	215	425	640	850	1060	140	280	420	560	700
5	207.5	412.5	620	825	1030	205	412.5	617.5	825	1030
6	205	410	610	820	1020	325	655	985	1310	1640
6	240	480	720	960	1200	50	120	205	305	445
6	222.5	445	665	890	1110	187.5	387.5	595	807.5	1042.5
7	200	400	600	800	1000	370	730	1070	1390	1670
7	200	400	610	830	1040	35	95	200	330	480
7	200	400	605	815	1020	202.5	417.5	635	860	1075
8	180	390	620	855	1015	360	700	1035	1345	1630
8	180	365	555	760	980	20	60	175	310	480
8	180	377.5	587.5	807.5	997.5	190	390	605	827.5	1055
9	220	440	660	880	1100	350	690	1020	1335	1635
9	150	330	530	740	930	- 20	- 15	+ 50	+100	+260
9	185	385	595	810	1015	165	337.5	525	747.5	947.5
10	170	370	580	800	1030	375	740	1090	1420	1700
10	150	330	530	740	960	0	10	70	170	270
10	160	350	555	770	995	187.5	375	580	795	985
11	160	340	540	740	950	370	720	1060	1375	1700
11	175	370	580	790	1005	50	70	155	275	420
11	167.5	355	500	765	977.5	210	395	607.5	825	1060
12	150	405	570	760	1000	330	660	970	1270	1560
12	200	505	720	950	1220	30	100	200	320	460
12	195	405	645	855	1110	180	380	585	795	1010

Strains in Micro-Inch Per Inch
 F indicates gage on front face
 B indicates gage on back face
 m indicates mean value

W indicates wind value
 F indicates type of bank face
 T indicates type of front face
 S indicates in three-inch per inch

Number	20	40	60	80	100	120	140	160	180
1	982	1270	1522	1732	1900	2020	2100	2150	2180
2	110	150	182	210	230	245	255	260	262
3	125.2	162	192	215	232	245	255	260	262
4	142	182	212	235	252	265	275	280	282
5	152	192	222	245	262	275	285	290	292
6	162	202	232	255	272	285	295	300	302
7	172	212	242	265	282	295	305	310	312
8	182	222	252	275	292	305	315	320	322
9	192	232	262	285	302	315	325	330	332
10	202	242	272	295	312	325	335	340	342
11	212	252	282	305	322	335	345	350	352
12	222	262	292	315	332	345	355	360	362
13	232	272	302	325	342	355	365	370	372
14	242	282	312	335	352	365	375	380	382
15	252	292	322	345	362	375	385	390	392
16	262	302	332	355	372	385	395	400	402
17	272	312	342	365	382	395	405	410	412
18	282	322	352	375	392	405	415	420	422
19	292	332	362	385	402	415	425	430	432
20	302	342	372	395	412	425	435	440	442
21	312	352	382	405	422	435	445	450	452
22	322	362	392	415	432	445	455	460	462
23	332	372	402	425	442	455	465	470	472
24	342	382	412	435	452	465	475	480	482
25	352	392	422	445	462	475	485	490	492
26	362	402	432	455	472	485	495	500	502
27	372	412	442	465	482	495	505	510	512
28	382	422	452	475	492	505	515	520	522
29	392	432	462	485	502	515	525	530	532
30	402	442	472	495	512	525	535	540	542
31	412	452	482	505	522	535	545	550	552
32	422	462	492	515	532	545	555	560	562
33	432	472	502	525	542	555	565	570	572
34	442	482	512	535	552	565	575	580	582
35	452	492	522	545	562	575	585	590	592
36	462	502	532	555	572	585	595	600	602
37	472	512	542	565	582	595	605	610	612
38	482	522	552	575	592	605	615	620	622
39	492	532	562	585	602	615	625	630	632
40	502	542	572	595	612	625	635	640	642
41	512	552	582	605	622	635	645	650	652
42	522	562	592	615	632	645	655	660	662
43	532	572	602	625	642	655	665	670	672
44	542	582	612	635	652	665	675	680	682
45	552	592	622	645	662	675	685	690	692
46	562	602	632	655	672	685	695	700	702
47	572	612	642	665	682	695	705	710	712
48	582	622	652	675	692	705	715	720	722
49	592	632	662	685	702	715	725	730	732
50	602	642	672	695	712	725	735	740	742
51	612	652	682	705	722	735	745	750	752
52	622	662	692	715	732	745	755	760	762
53	632	672	702	725	742	755	765	770	772
54	642	682	712	735	752	765	775	780	782
55	652	692	722	745	762	775	785	790	792
56	662	702	732	755	772	785	795	800	802
57	672	712	742	765	782	795	805	810	812
58	682	722	752	775	792	805	815	820	822
59	692	732	762	785	802	815	825	830	832
60	702	742	772	795	812	825	835	840	842
61	712	752	782	805	822	835	845	850	852
62	722	762	792	815	832	845	855	860	862
63	732	772	802	825	842	855	865	870	872
64	742	782	812	835	852	865	875	880	882
65	752	792	822	845	862	875	885	890	892
66	762	802	832	855	872	885	895	900	902
67	772	812	842	865	882	895	905	910	912
68	782	822	852	875	892	905	915	920	922
69	792	832	862	885	902	915	925	930	932
70	802	842	872	895	912	925	935	940	942
71	812	852	882	905	922	935	945	950	952
72	822	862	892	915	932	945	955	960	962
73	832	872	902	925	942	955	965	970	972
74	842	882	912	935	952	965	975	980	982
75	852	892	922	945	962	975	985	990	992
76	862	902	932	955	972	985	995	1000	1002
77	872	912	942	965	982	995	1005	1010	1012
78	882	922	952	975	992	1005	1015	1020	1022
79	892	932	962	985	1002	1015	1025	1030	1032
80	902	942	972	995	1012	1025	1035	1040	1042
81	912	952	982	1005	1022	1035	1045	1050	1052
82	922	962	992	1015	1032	1045	1055	1060	1062
83	932	972	1002	1025	1042	1055	1065	1070	1072
84	942	982	1012	1035	1052	1065	1075	1080	1082
85	952	992	1022	1045	1062	1075	1085	1090	1092
86	962	1002	1032	1055	1072	1085	1095	1100	1102
87	972	1012	1042	1065	1082	1095	1105	1110	1112
88	982	1022	1052	1075	1092	1105	1115	1120	1122
89	992	1032	1062	1085	1102	1115	1125	1130	1132
90	1002	1042	1072	1095	1112	1125	1135	1140	1142
91	1012	1052	1082	1105	1122	1135	1145	1150	1152
92	1022	1062	1092	1115	1132	1145	1155	1160	1162
93	1032	1072	1102	1125	1142	1155	1165	1170	1172
94	1042	1082	1112	1135	1152	1165	1175	1180	1182
95	1052	1092	1122	1145	1162	1175	1185	1190	1192
96	1062	1102	1132	1155	1172	1185	1195	1200	1202
97	1072	1112	1142	1165	1182	1195	1205	1210	1212
98	1082	1122	1152	1175	1192	1205	1215	1220	1222
99	1092	1132	1162	1185	1202	1215	1225	1230	1232
100	1102	1142	1172	1195	1212	1225	1235	1240	1242

Table of Area and Volume of Section

Section 11

Table 11

TABLE IV (Cont.)

Gage Number	Plate of Zero Nominal Deflection					Plate of 1/8" Nominal Deflection				
	Load in Kips					Load in Kips				
	20	40	60	80	100	20	40	60	80	100
13	155	315	475	650	830	270	530	780	1020	1250
13	220	430	645	860	1080	130	275	415	560	710
13	187.5	372.5	560	755	955	200	402.5	597.5	790	980
14	180	360	540	720	900	245	490	720	945	1150
14	190	380	560	745	920	225	445	660	860	1050
14	185	370	550	732.5	910	235	467.5	690	902.5	1100
15	205	410	620	825	1030	255	510	750	980	1180
15	165	335	500	670	835	230	460	685	900	1100
15	185	372.5	560	747.5	932.5	242.5	485	717.5	940	1140
16	255	500	745	980	1210	295	555	800	1030	1260
16	145	285	430	580	680	230	450	650	850	1050
16	200	392.5	587.5	780	945	262.5	502.5	725	940	1155
17	270	540	810	1080	1360	265	520	775	1020	1265
17	95	200	320	440	565	190	380	560	720	930
17	182.5	370	565	760	962.5	227.5	450	662.5	870	1097
18F	205	410	615	820	1150	240	485	730	970	1210
18B	205	415	625	830	1200	200	405	610	810	1010
18M	205	412.5	620	825	1175	220	445	670	890	1110
19F	200	400	600	805	1050	230	460	690	925	1160
19B	200	400	600	805	1080	110	225	340	450	530
19M	200	400	600	805	1065	170	342.5	505	687.5	845
20F	200	400	600	800	1000	250	500	755	1010	1260
20B	210	420	630	840	1050	115	235	350	470	590
20M	205	410	615	820	1025	182.5	367.5	552.5	740	925
21F	220	440	655	870	1090	240	485	730	970	1220
21B	195	395	595	790	990	170	340	520	690	870
21M	207.5	417.5	625	830	1040	205	412.5	625	830	1045
22F	180	360	545	730	910	245	490	735	980	1230
22B	225	450	680	905	1130	150	310	465	620	780
22M	202.5	405	612.5	817.5	1020	197.5	400	600	800	1005
23F	185	370	550	740	925	260	520	790	1060	1320
23B	220	440	660	880	1105	110	225	340	450	660
23M	202.5	405	605	810	1015	185	372.5	565	755	990
24F	190	390	580	775	870	270	545	820	1090	1570
24B	225	450	675	900	1120	105	220	330	440	520
24M	207.5	420	627.5	837.5	1045	187.5	382.5	575	765	1045
25F	165	335	500	665	900	240	480	725	960	1210
25B	195	390	600	830	1140	170	340	520	690	870
25M	180	362.5	550	747.5	1020	205	410	622.5	825	1040

Strains in Micro-Inch Per inch

F indicates gage on front face

B indicates gage on back face

M indicates mean value

It indicates mean value
 It indicates range or best form
 It indicates range or best form
 It indicates the difference from

Age	20	30	40	50	60	70	80	90	100
10	100	100	100	100	100	100	100	100	100
20	100	100	100	100	100	100	100	100	100
30	100	100	100	100	100	100	100	100	100
40	100	100	100	100	100	100	100	100	100
50	100	100	100	100	100	100	100	100	100
60	100	100	100	100	100	100	100	100	100
70	100	100	100	100	100	100	100	100	100
80	100	100	100	100	100	100	100	100	100
90	100	100	100	100	100	100	100	100	100
100	100	100	100	100	100	100	100	100	100

Table of the Normal Distribution
 Load in Pounds
 Load in Pounds

TABLE IV (Cont.)

Plate of Zero Nominal Deflection						Plate of 1/8" Nominal Deflection				
Gage Number	Load in Kips					Load in Kips				
	20	40	60	80	100	20	40	60	80	100
26F	190	380	570	760	955	215	430	660	900	1135
26B	180	370	560	750	940	130	200	390	520	650
26M	185	375	565	755	947.5	172.5	345	525	760	892.5
27F	195	390	585	780	1080	250	510	765	1020	1275
27B	165	335	510	690	1000	115	230	350	570	680
27M	180	362.5	547.5	735	1040	182.5	370	557.5	795	977.5
28F	190	380	575	765	1080	240	490	735	980	1220
28B	165	335	510	685	990	200	400	605	810	1010
28M	180	357.5	542.5	725	1035	220	445	670	895	1115
A	150	275	390	500	620	145	290	420	530	620
D	140	260	375	480	605	150	300	435	560	670
-M	145	267.5	382.5	490	612.5	147.5	295	427.5	545	645
B	-15	-35	-60	-95	-145	-10	-20	-40	-80	-145
C	-25	-55	-90	-125	-170	-00	0	0	-10	-75
-H	-20	-45	-75	-110	-157.5	-5	-10	-20	-45	-110
E	80	165	250	335	415	150	285	415	530	620
H	100	200	300	400	500	140	270	395	505	595
-M	90	182.5	275	362.5	457.5	145	277.5	405	517.5	607.5
F	-30	-00	-100	-140	190	+20	+40	+60	+60	0
G	-20	-40	-70	-95	135	+5	+10	+10	-10	-60
-M	-25	-50	-85	117.5	162.5	125	25	35	25	-30

Strains in Micro-Inch Per Inch

F indicates gage on front face

B indicates gage on back face

M indicates mean value

Table of New Contract Negotiations

Table of New Contract Negotiations

Load in Tons

Load in Tons

Contract Number	10	20	30	40	50	60	70	80	90	100
1	150	150	150	150	150	150	150	150	150	150
2	150	150	150	150	150	150	150	150	150	150
3	150	150	150	150	150	150	150	150	150	150
4	150	150	150	150	150	150	150	150	150	150
5	150	150	150	150	150	150	150	150	150	150
6	150	150	150	150	150	150	150	150	150	150
7	150	150	150	150	150	150	150	150	150	150
8	150	150	150	150	150	150	150	150	150	150
9	150	150	150	150	150	150	150	150	150	150
10	150	150	150	150	150	150	150	150	150	150
11	150	150	150	150	150	150	150	150	150	150
12	150	150	150	150	150	150	150	150	150	150
13	150	150	150	150	150	150	150	150	150	150
14	150	150	150	150	150	150	150	150	150	150
15	150	150	150	150	150	150	150	150	150	150
16	150	150	150	150	150	150	150	150	150	150
17	150	150	150	150	150	150	150	150	150	150
18	150	150	150	150	150	150	150	150	150	150
19	150	150	150	150	150	150	150	150	150	150
20	150	150	150	150	150	150	150	150	150	150
21	150	150	150	150	150	150	150	150	150	150
22	150	150	150	150	150	150	150	150	150	150
23	150	150	150	150	150	150	150	150	150	150
24	150	150	150	150	150	150	150	150	150	150
25	150	150	150	150	150	150	150	150	150	150
26	150	150	150	150	150	150	150	150	150	150
27	150	150	150	150	150	150	150	150	150	150
28	150	150	150	150	150	150	150	150	150	150
29	150	150	150	150	150	150	150	150	150	150
30	150	150	150	150	150	150	150	150	150	150
31	150	150	150	150	150	150	150	150	150	150
32	150	150	150	150	150	150	150	150	150	150
33	150	150	150	150	150	150	150	150	150	150
34	150	150	150	150	150	150	150	150	150	150
35	150	150	150	150	150	150	150	150	150	150
36	150	150	150	150	150	150	150	150	150	150
37	150	150	150	150	150	150	150	150	150	150
38	150	150	150	150	150	150	150	150	150	150
39	150	150	150	150	150	150	150	150	150	150
40	150	150	150	150	150	150	150	150	150	150
41	150	150	150	150	150	150	150	150	150	150
42	150	150	150	150	150	150	150	150	150	150
43	150	150	150	150	150	150	150	150	150	150
44	150	150	150	150	150	150	150	150	150	150
45	150	150	150	150	150	150	150	150	150	150
46	150	150	150	150	150	150	150	150	150	150
47	150	150	150	150	150	150	150	150	150	150
48	150	150	150	150	150	150	150	150	150	150
49	150	150	150	150	150	150	150	150	150	150
50	150	150	150	150	150	150	150	150	150	150

Contract in this column for load
to indicate year on load
to indicate year on load
to indicate year on load

TABLE IV (Cont.)

Strain Load Values

Gage Number	Plate of 3/16" Nominal Deflection					Plate of 1/4" Nominal Deflection				
	Load in Kips					Load in Kips				
	20	40	60	80	100	20	40	60	80	100
1F	215	435	655	875	1115	225	415	600	785	1010
1B	235	480	720	960	1220	255	500	720	940	1200
1M	225	457.5	687.5	917.5	1167.5	240	457.5	660	862.5	1105
2F	230	450	675	900	1035	240	475	705	915	1065
2B	250	490	735	975	1125	240	475	705	915	1055
2M	240	470	705	932.5	1080	240	475	705	915	1060
3F	250	500	750	1000	1140	250	490	725	935	1110
3B	240	480	720	965	1130	265	510	730	935	1090
3M	245	490	735	982.5	1135	257.5	500	727.5	935	1100
4F	270	540	810	1080	1390	310	600	865	1115	1810
4B	240	470	710	950	1230	250	490	720	930	1500
4M	255	505	760	1015	1310	280	545	792.5	1022.5	1685
5F	305	610	925	1230	1420	410	810	1175	1510	1820
5B	75	150	225	310	600	20	45	95	165	310
5M	190	380	575	770	1010	215	427.5	635	837.5	1065
6F	400	810	1220	1620	1740	600	1100	1580	2000	2700
6B	-70	-115	-110	-90	+100	-200	-320	-380	-390	-90
6M	165	347.5	555	765	920	200	390	600	805	1305
7F	470	935	1400	1800	1960	560	1070	1540	1970	2570
7B	-140	-245	-315	330	-125	-220	-360	-440	-460	-270
7M	165	345	542.5	735	917.5	170	355	550	755	1150
8F	450	885	1290	1660	1760	520	990	1440	1860	2200
8B	-160	-270	-320	-300	-155	-300	-530	-690	-800	-550
8M	145	307.5	485	680	802.5	110	230	375	530	825
9F	440	860	1260	1640	1710	600	1100	1580	2250	2430
9B	-90	-165	-210	-195	+60	-280	-480	-620	-700	-500
9M	175	347.5	525	722.5	885	160	310	480	775	960
10F	620	1120	1560	1980	2390	560	1080	1560	2040	2410
10B	-110	-180	-200	-140	+200	-300	-520	-690	-790	-500
10M	260	470	680	920	1295	130	280	435	625	925
11F	490	950	1380	1760	1830	580	1100	1600	2090	2400
11B	-130	-220	-250	-220	-10	-280	-530	-700	-810	-480
11M	180	365	565	770	910	150	285	450	640	960
12F	450	990	1300	1690	1660	520	1000	1460	1990	2160
12B	-35	-50	-45	+10	+230	-220	-390	-510	-600	-100
12M	207.5	470	677.5	850	945	150	305	475	695	1030

Strain Micro-Inch Per Inch

F indicates gage on front face

B indicates gage on back face

M indicates mean value

TABLE IV (Contd.)

Station Load Values

Plate of 3.16" Nominal Thickness Plate of 1/4" Nominal Thickness

Load in kips	Load in kips										Load in kips
	100	50	00	10	20	30	40	50	60	70	
100	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
90	900	900	900	900	900	900	900	900	900	900	900
80	800	800	800	800	800	800	800	800	800	800	800
70	700	700	700	700	700	700	700	700	700	700	700
60	600	600	600	600	600	600	600	600	600	600	600
50	500	500	500	500	500	500	500	500	500	500	500
40	400	400	400	400	400	400	400	400	400	400	400
30	300	300	300	300	300	300	300	300	300	300	300
20	200	200	200	200	200	200	200	200	200	200	200
10	100	100	100	100	100	100	100	100	100	100	100
00	000	000	000	000	000	000	000	000	000	000	000
10	100	100	100	100	100	100	100	100	100	100	100
20	200	200	200	200	200	200	200	200	200	200	200
30	300	300	300	300	300	300	300	300	300	300	300
40	400	400	400	400	400	400	400	400	400	400	400
50	500	500	500	500	500	500	500	500	500	500	500
60	600	600	600	600	600	600	600	600	600	600	600
70	700	700	700	700	700	700	700	700	700	700	700
80	800	800	800	800	800	800	800	800	800	800	800
90	900	900	900	900	900	900	900	900	900	900	900
100	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Station Name-Load per inch
 1/2 inch wide plate on front face
 1/2 inch wide plate on back face
 1/2 inch wide plate

TABLE IV (Cont.)

Strain Load Values

Plate of 3/16" Nominal Deflection

Plate of 1/4" Nominal Deflection

Gage Number	Load in Kips					Load in Kips				
	20	40	60	80	100	20	40	60	80	100
13F	330	660	1000	1330	1700	440	840	1190	1560	2710
13B	85	180	280	400	730	-20	-40	-40	-20	200
13M	207.5	420	640	865	1215	210	400	575	770	1455
14F	275	550	830	1105	1500	350	660	950	1230	2600
14B	265	510	720	990	1300	260	510	740	960	3160
14M	270	530	775	1047.5	1400	305	585	845	1095	2880
15F	290	550	780	1000	1900	285	545	795	1035	1200
15B	260	515	760	1005	1845	285	545	795	1040	1300
15M	275	532.5	770	1002.5	1872.5	285	545	795	1037.5	1250
16F	290	560	790	1010	1310	240	480	710	920	990
16B	275	530	760	970	1265	280	560	830	1075	1210
16M	282.5	545	775	990	1287.5	240	520	770	997.5	1100
17F	235	470	705	940	1160	200	400	600	800	860
17B	235	470	705	940	1180	290	565	830	1070	1230
17M	235	470	705	940	1170	245	482.5	715	935	1045
18F	285	570	855	1140	1450	300	570	815	1050	1405
18B	215	430	650	860	1080	230	445	650	840	1065
18M	250	500	752.5	1000	1265	265	507.5	732.5	945	1235
19F	220	440	665	890	1340	260	505	730	960	1380
19B	100	205	310	405	275	100	195	290	380	450
19M	160	322.5	487.5	647.5	807.5	180	350	510	670	915
20F	185	370	560	740	950	150	305	460	620	960
20B	125	260	385	520	705	160	325	485	650	880
20M	155	315	472.5	630	827.5	155	315	472.5	635	920
21F	120	245	370	495	700	70	150	255	390	630
21B	240	480	720	950	1160	220	440	670	880	960
21M	180	362.5	545	722.5	930	145	295	462.5	635	795
22F	160	320	490	685	1050	80	165	285	445	710
22B	140	300	490	630	800	160	320	480	640	820
22M	150	310	490	657.5	925	120	242.5	382.5	542.5	765
23F	150	295	450	630	1000	40	120	225	365	645
23B	205	410	600	735	830	190	390	580	770	880
23M	177.5	352.5	525	682.5	915	115	255	402.5	567.5	762.5
24F	170	335	505	685	990	250	485	720	960	1450
24B	240	480	720	920	1170	30	65	130	235	450
24M	205	407.5	612.5	802.5	1080	140	275	425	597.5	950
25F	80	175	285	440	690	-20	-25	0	60	290
25B	300	585	860	1095	1330	220	440	660	880	100.0
25M	190	380	572.5	767.5	1010	100	207.5	330	470	645

Strain in Micro Inch Per Inch

F indicates gage on front face

B indicates gage on back face

M indicates mean value

1. Indicated mass on front face
 2. Indicated mass on back face
 3. Indicated mass value

Weight	10	20	30	40	50	60	70	80	90	100
100	100	100	100	100	100	100	100	100	100	100
90	90	90	90	90	90	90	90	90	90	90
80	80	80	80	80	80	80	80	80	80	80
70	70	70	70	70	70	70	70	70	70	70
60	60	60	60	60	60	60	60	60	60	60
50	50	50	50	50	50	50	50	50	50	50
40	40	40	40	40	40	40	40	40	40	40
30	30	30	30	30	30	30	30	30	30	30
20	20	20	20	20	20	20	20	20	20	20
10	10	10	10	10	10	10	10	10	10	10
0	0	0	0	0	0	0	0	0	0	0

Average Load Values
 Table 17 (Cont.)

Load in lbs
 Weight of 3/16" nominal section
 Area of 3/16" nominal section

TABLE IV (Cont.)

Strain Load Values

Plate of 3/16" Nominal Deflection						Plate of 1/4" Nominal Deflection				
Load in Kips						Load in Kips				
Gage Number	20	40	60	80	100	20	40	60	80	100
26F	170	345	515	700	975	160	220	320	450	780
26B	230	460	700	820	970	140	280	420	560	645
26M	200	402.5	607.5	760	972.5	125	250	370	505	717.5
27F	245	500	770	1060	1550	220	430	625	815	1860
27B	170	330	500	600	570	120	235	340	450	540
27M	207.5	415	635	830	1060	170	332.5	482.5	632.5	1200
28F	310	590	850	1080	1310	260	500	730	950	2340
28B	235	450	640	810	950	200	390	590	780	20.00
28M	272.5	520	745	945	1130	230	445	660	865	2170
A	140	275	400	510	730	120	230	350	460	800
B	170	340	490	630	910	140	280	410	540	890
-	155	307.5	445	570	820	130	255	380	500	845
B	-50	-90	-135	-190	-315	-100	-180	-225	-275	-385
C	-5	-5	-10	-25	-100	-55	-75	-100	-115	-190
-	-27.5	-47.5	-72.5	-107.5	-207.5	-77.5	-127.5	-162.5	-195	-287.5
E	170	350	485	600	980	160	320	470	605	2005
H	115	230	340	455	710	110	225	335	445	1540
-	142.5	290	412.5	527.5	845	135	272.5	402.5	525	1772.5
F	+10	+10	+5	-25	-90	-55	-95	-130	-160	-340
G	-70	-125	-180	-245	-370	-75	-230	-315	-375	-615
-	-30	-57.5	-85	-135	-230	-65	-162.5	-222.5	-267.5	-477.5

Strain in Micro Inch Per Inch
 F indicates gage on front face
 B indicates gage on back face
 M indicates mean value

TABLE IV (Cont.)

Plain Iron Values

Plate of 3/16" Section

Load in Kips

Order Number	70	80	90	100	110	120	130	140	150	160
1	170	342	512	680	842	1000	1152	1300	1450	1600
2	230	460	690	920	1150	1380	1610	1840	2070	2300
3	290	580	870	1160	1450	1740	2030	2320	2610	2900
4	350	700	1050	1400	1750	2100	2450	2800	3150	3500
5	410	820	1230	1640	2050	2460	2870	3280	3690	4100
6	470	940	1410	1920	2400	2880	3360	3840	4320	4800
7	530	1060	1590	2180	2760	3320	3880	4440	5000	5560
8	590	1180	1770	2440	3120	3780	4440	5100	5760	6420
9	650	1300	1950	2700	3480	4240	4900	5560	6220	6880
10	710	1420	2130	2960	3840	4600	5260	5920	6580	7240
11	770	1540	2310	3220	4200	5000	5660	6320	6980	7640
12	830	1660	2490	3480	4560	5400	6060	6720	7380	8040
13	890	1780	2670	3740	4920	5800	6460	7120	7780	8440
14	950	1900	2850	4000	5280	6200	6820	7480	8140	8800
15	1010	2020	3030	4260	5640	6600	7220	7880	8540	9200
16	1070	2140	3210	4520	6000	7000	7620	8280	8940	9600
17	1130	2260	3390	4780	6360	7400	8020	8680	9340	10000
18	1190	2380	3570	5040	6720	7800	8420	9080	9740	10400
19	1250	2500	3750	5300	7080	8200	8820	9480	10140	10800
20	1310	2620	3930	5560	7440	8600	9220	9880	10540	11200
21	1370	2740	4110	5820	7800	9000	9620	10280	10940	11600
22	1430	2860	4290	6080	8160	9400	10020	10680	11340	12000
23	1490	2980	4470	6340	8520	9800	10420	11080	11740	12400
24	1550	3100	4650	6600	8880	10200	10820	11480	12140	12800
25	1610	3220	4830	6860	9240	10600	11220	11880	12540	13200
26	1670	3340	5010	7120	9600	11000	11620	12280	12940	13600
27	1730	3460	5190	7380	9960	11400	12020	12680	13340	14000
28	1790	3580	5370	7640	10320	11800	12420	13080	13740	14400
29	1850	3700	5550	7900	10680	12200	12820	13480	14140	14800
30	1910	3820	5730	8160	11040	12600	13220	13880	14540	15200
31	1970	3940	5910	8420	11400	13000	13620	14280	14940	15600
32	2030	4060	6090	8680	11760	13400	14020	14680	15340	16000
33	2090	4180	6270	8940	12120	13800	14420	15080	15740	16400
34	2150	4300	6450	9200	12480	14200	14820	15480	16140	16800
35	2210	4420	6630	9460	12840	14600	15220	15880	16540	17200
36	2270	4540	6810	9720	13200	15000	15620	16280	16940	17600
37	2330	4660	6990	9980	13560	15400	16020	16680	17340	18000
38	2390	4780	7170	10240	13920	15800	16420	17080	17740	18400
39	2450	4900	7350	10500	14280	16200	16820	17480	18140	18800
40	2510	5020	7530	10760	14640	16600	17220	17880	18540	19200
41	2570	5140	7710	11020	15000	17000	17620	18280	18940	19600
42	2630	5260	7890	11280	15360	17400	18020	18680	19340	20000
43	2690	5380	8070	11540	15720	17800	18420	19080	19740	20400
44	2750	5500	8250	11800	16080	18200	18820	19480	20140	20800
45	2810	5620	8430	12060	16440	18600	19220	19880	20540	21200
46	2870	5740	8610	12320	16800	19000	19620	20280	20940	21600
47	2930	5860	8790	12580	17160	19400	20020	20680	21340	22000
48	2990	5980	8970	12840	17520	19800	20420	21080	21740	22400
49	3050	6100	9150	13100	17880	20200	20820	21480	22140	22800
50	3110	6220	9330	13360	18240	20600	21220	21880	22540	23200

Values in Kips Per Inch
 Indicated here on front face
 Indicated here on back face
 Indicated mean value

APPENDIX C

AVERAGE INITIAL DEFLECTION AND AVERAGE
STRAIN CALCULATIONS

DEC 1996

ADVANCE INITIAL POSITION AND ADVANCE

2001-2002

TABLE V

Calculation of Unwarped Deflection

Plate of 100 Nominal Deflection

Upper Edge Lower Edge Center

-3	-47	-26
-5	-52	-27
+1	-64	-35
-3	-55	-35
-6	-53	-43
-7	-53	-43
-11	-39	-43
-10	-37	-6
-2	-26	+5
2	-24	+6
+7	-33	+1

-43	-473	-157
	-16	+105
	-518	+112

Average -253

= 0.0093"
= 0.175"
= 0.3715

Plate of 100 Nominal Deflection

Upper Edge Lower Edge Center

-4	-46	74
-13	-34	74
-13	-26	74
-10	-16	79
-13	-13	81
-14	-17	80
-8	-5	81
-4	17	79
+9	+13	65
+6	+10	53
+1	+2	71

-51	-50	+107
	-51	+37
	-124	+101

-37

= 0.0093"
= 0.175"
= 0.3715

Plate of 2 1/2" Nominal Deflection

Upper Edge Lower Edge Center

10	-33	134
12	-46	122
21	-50	121
32	-56	143
31	-64	149
33	-66	149
30	-68	132
28	-68	131
17	-56	133
14	-5	121
16	-3	121

+274	-646	+1190
	+71	+167
	-531	+2657

Average -167

= 0.0056"
= 0.105"
= 0.205

Plate of 2 1/2" Nominal Deflection

Upper Edge Center Lower Edge

-45	140	-37
-51	146	-36
-61	176	-47
-72	181	-41
-71	180	-38
-63	180	-33
-48	183	-38
-3	180	-45
-39	188	-43
-16	187	-46
-12	181	-41

-50	+107	-106
	+37	-101
	+101	-106

= 0.0056"
= 0.105"
= 0.205

TABLE VI

Calculation of the Mean Strain

Plate of Zero Nominal Deflection						Plate of 3/16" Nominal Deflection				
Load(Kips)	20	40	60	80	100	20	40	60	80	100
	Strain (Micro-inch Per Inch)						Strain (Micro-inch Per Inch)			
	9.0	20.0	29.5	39.3	47.8	11	22.5	34	45.6	59.9
	9.7	20.0	30.0	40.0	49.0	12.2	24.0	36.2	48.3	55.9
	10.1	20.4	31.2	41.3	51.7	12.0	24.0	36.0	48.2	62.2
	10.2	21.7	32.7	43.3	54.0	8.7	17.8	28.0	38.2	47.2
	10.0	20.0	30.0	41.0	51.0	8.3	17.2	27.0	36.8	46.0
	9.0	18.8	29.4	30.2	49.8	7.4	15.5	24.2	34.0	40.2
	9.5	19.0	29.8	40.5	50.8	8.8	17.3	26.3	36.1	44.0
	8.0	17.5	28.0	38.3	49.6	13.0	23.4	34.0	46.0	64.8
	8.2	18.0	28.0	38.0	48.0	9.1	18.4	28.2	38.5	45.3
	9.0	19.4	30.3	40.3	51.8	10.3	22.6	33.2	42.7	51.5
	9.2	18.5	27.5	36.7	45.6	13.0	25.8	38.0	50.0	70.0
	9.5	19.0	28.5	38.0	46.7	14.0	26.9	38.7	49.8	65.3
	8.8	18.0	28.0	37.7	48.5	10.5	21.6	33.5	45.9	56.1

Sum 120.2 250.3 392.9 504.6 639.3 138.3 277.0 417.3 570.1 708.4

Mean Value 185 384.5 604.8 775 982.5 212.8 426 642 876 1090

Plate of 1/8" Nominal Deflection Plate of 1/4" Nominal Deflection

Strain (Micro-inch Per Inch)					Strain (Micro-inch Per Inch)				
11.1	22.3	33.7	45.0	56.0	12.0	22.4	32.2	42.1	56.1
11.6	23.3	35.0	47.0	58.5	12.5	24.6	36.0	46.4	54.3
11.8	23.9	35.3	47.0	58.7	13.6	26.3	38.3	49.8	79.1
9.8	19.8	30.0	40.8	51.9	10.2	20.0	30.6	40.8	61.5
10.0	21.0	31.8	42.8	53.7	8.4	18.0	27.2	37.7	57.3
9.5	19.5	30.2	41.5	53.0	5.5	11.6	18.8	26.6	41.1
8.0	16.8	26.2	37.2	47.3	7.8	15.2	23.7	37.3	47.8
9.2	18.7	29.0	39.7	49.2	6.7	14.0	21.9	31.3	46.2
10.5	19.7	30.2	41.2	53.0	7.5	14.3	22.5	32.0	48.0
9.5	19.5	29.5	39.5	49.5	8.5	17.0	25.4	36.0	58.5
11.4	23.0	34.0	44.3	54.0	14.7	28.0	40.6	53.0	129.0
12.4	24.5	36.0	47.0	57.2	13.3	26.7	39.1	41.0	60.8

Sum 135.0 273.0 412.4 554.5 694.8 133.1 261.4 390.5 529.0 788.7

Mean Value 207.7 420 633 851 1069 204.8 402 601 813 1212

17th of June 1946

Load (lbs)	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910	920	930	940	950	960	970	980	990	1000
Strain (Micro-Inch per Inch)	18.0	38.0	57.7	76.7	95.0	112.7	130.0	147.0	163.7	180.0	196.0	211.7	227.0	242.0	257.0	271.7	286.0	300.0	314.0	327.7	341.0	354.0	367.0	380.0	393.0	406.0	419.0	432.0	445.0	458.0	471.0	484.0	497.0	510.0	523.0	536.0	549.0	562.0	575.0	588.0	601.0	614.0	627.0	640.0	653.0	666.0	679.0	692.0	705.0	718.0	731.0	744.0	757.0	770.0	783.0	796.0	809.0	822.0	835.0	848.0	861.0	874.0	887.0	900.0	913.0	926.0	939.0	952.0	965.0	978.0	991.0	1000.0																								

100% 520% 385% 607% 9.89% 2.00% 0.00% 0.00% 0.00%

3000.2 801.8 112 300.2 575.4 760 070 050 1000

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System (Micro-inch Per Inch)		System (Micro-inch Per Inch)	
11.1	25.3	11.1	25.3
11.4	25.3	11.4	25.3
11.8	25.3	11.8	25.3
9.8	30.0	9.8	30.0
10.0	31.8	10.0	31.8
9.2	30.5	9.2	30.5
8.0	30.8	8.0	30.8
9.2	30.7	9.2	30.7
10.2	30.3	10.2	30.3
9.2	30.2	9.2	30.2
11.1	30.0	11.1	30.0
12.1	30.2	12.1	30.2

7.807 0.492 2.072 4.108 1.331 8.069 2.112 4.914 0.433 0.251

092 84 108 0.000 000 000 000 000

TABLE VII

Calculation of the Average Maximum StrainFront Face

Load (Kips)	Gage Number	NOMINAL DEFLECTION			
		0	1/8	3/16	1/4
20	7	200	370	470	560
	11	160	370	490	580
	Average	180	370	480	570
	Ratio	0.973	1.782	2.255	2.78
40	7	400	730	935	1070
	11	340	720	950	1100
	Average	370	725	942.5	1085
	Ratio	0.962	1.728	2.215	2.70
60	7	600	1070	1400	1540
	11	540	1060	1380	1000
	Average	570	1065	1390	1570
	Ratio	0.945	1.684	2.165	2.615
80	7	800	1390	1800	1970
	11	740	1375	1760	2090
	Average	770	1382.5	1780	2030
	Ratio	0.933	1.626	2.030	2.498
100	7	1000	1670	1960	2570
	11	950	1700	1830	2400
	Average	975	1685	1925	2485
	Ratio	0.993	1.578	1.766	2.050

TABLE VII

Calculation of the Average Section Stress

Prestress

Load (kips)	Load Factor	0	110	220	330
50	1.1	300	310	320	330
	Ratio	0.913	1.000	1.087	1.174
100	1.1	400	410	420	430
	Ratio	0.913	1.000	1.087	1.174
150	1.1	500	510	520	530
	Ratio	0.913	1.000	1.087	1.174
200	1.1	600	610	620	630
	Ratio	0.913	1.000	1.087	1.174
250	1.1	700	710	720	730
	Ratio	0.913	1.000	1.087	1.174
300	1.1	800	810	820	830
	Ratio	0.913	1.000	1.087	1.174
350	1.1	900	910	920	930
	Ratio	0.913	1.000	1.087	1.174
400	1.1	1000	1010	1020	1030
	Ratio	0.913	1.000	1.087	1.174

TABLE VII (Cont.)

Calculation of the Average Minimum Strain

Load (Kips)	Gage Number	Back Face			
		NOMINAL DEFLECTION			
		0"	1/8"	3/16"	1/4"
20	8	180	20	-160	- 300
	9	150	-20	- 90	- 280
	10	150	0	-110	- 300
	Average	160	0	-120	- 293.3
	Ratio	0.865	0	-0.564	-1.430
40	8	365	80	-270	- 530
	9	330	-15	-165	- 480
	10	330	10	-180	- 520
	Average	341.6	25	-205	- 510
	Ratio	0.888	0.059	-0.481	-1.269
60	8	555	175	-320	- 690
	9	530	50	-210	- 620
	10	530	70	-200	- 690
	Average	538.3	98.3	-243.3	- 666.6
	Ratio	0.891	0.155	-0.379	-1.109
80	8	760	310	-300	- 800
	9	740	160	-195	- 700
	10	740	170	-140	- 790
	Average	746.6	213.3	-211.6	- 763.3
	Ratio	0.964	0.250	-0.241	-0.949
100	8	980	480	-155	- 550
	9	930	260	+ 60	- 510
	10	960	270	+300	- 560
	Average	956.6	336.0	+ 35	- 540
	Ratio	0.975	0.315	0.032	-0.445

TABLE VII (Cont.)

Calculation of the Average Annual Growth

Growth Rate

Year	1950	1951	1952	1953	1954
100	100	100	100	100	100
90	90	90	90	90	90
80	80	80	80	80	80
70	70	70	70	70	70
60	60	60	60	60	60
50	50	50	50	50	50
40	40	40	40	40	40
30	30	30	30	30	30
20	20	20	20	20	20
10	10	10	10	10	10
0	0	0	0	0	0
-10	-10	-10	-10	-10	-10
-20	-20	-20	-20	-20	-20
-30	-30	-30	-30	-30	-30
-40	-40	-40	-40	-40	-40
-50	-50	-50	-50	-50	-50
-60	-60	-60	-60	-60	-60
-70	-70	-70	-70	-70	-70
-80	-80	-80	-80	-80	-80
-90	-90	-90	-90	-90	-90
-100	-100	-100	-100	-100	-100
Average	0.000	0.000	0.000	0.000	0.000
Ratio	1.000	1.000	1.000	1.000	1.000

TABLE VII (Cont.)

Calculation of the Average Maximum StrainMiddle Depth

Load (Kips)	Gage Number	NOMINAL DEFLECTION			
		0"	1/8"	3/16"	1/4"
20	4	205	242.5	255	280
	14	185	235	270	305
	Average	195	238.7	262.5	292.5
	Ratio	1.055	1.150	1.232	1.429
40	4	410	492.5	505	545
	14	370	467.5	530	585
	Average	390	480.0	517.5	565
	Ratio	1.013	1.143	1.215	1.406
60	4	625	727.5	760	792.5
	14	550	690.0	775	845.0
	Average	587.5	708.7	767.5	818.7
	Ratio	0.972	1.120	1.196	1.361
80	4	830	967.5	1015	1022.5
	14	732.5	902.5	1047.5	1995.0
	Average	781.2	935.0	1031.2	1508.7
	Ratio	1.009	1.100	1.179	1.855
100	4	1035	1210	1310	1685
	14	910	1100	1400	2880
	Average	972.5	1155	1355	2282
	Ratio	0.990	1.081	1.242	1.886

TABLE II (Cont.)

(Continuation of the average maximum values)

British Tons

Load (tons)	Deck Number	On	NORMAL INVESTIGATION	Off
20	1	40.5	40.5	40.5
	11	10.5	10.5	10.5
	Average	19.5	23.5	23.5
40	Ratio	1.000	1.120	1.120
60	1	41.0	41.0	41.0
	11	31.0	31.0	31.0
	Average	36.0	40.0	40.0
	Ratio	1.000	1.113	1.113
80	1	42.0	42.0	42.0
	11	32.0	32.0	32.0
	Average	37.0	40.0	40.0
	Ratio	1.000	1.075	1.075
100	1	43.0	43.0	43.0
	11	33.0	33.0	33.0
	Average	38.0	40.0	40.0
	Ratio	1.000	1.060	1.060
120	1	44.0	44.0	44.0
	11	34.0	34.0	34.0
	Average	39.0	40.0	40.0
	Ratio	1.000	1.050	1.050
140	1	45.0	45.0	45.0
	11	35.0	35.0	35.0
	Average	40.0	40.0	40.0
	Ratio	1.000	1.040	1.040
160	1	46.0	46.0	46.0
	11	36.0	36.0	36.0
	Average	41.0	40.0	40.0
	Ratio	1.000	1.030	1.030
180	1	47.0	47.0	47.0
	11	37.0	37.0	37.0
	Average	42.0	40.0	40.0
	Ratio	1.000	1.020	1.020
200	1	48.0	48.0	48.0
	11	38.0	38.0	38.0
	Average	43.0	40.0	40.0
	Ratio	1.000	1.010	1.010
220	1	49.0	49.0	49.0
	11	39.0	39.0	39.0
	Average	44.0	40.0	40.0
	Ratio	1.000	1.000	1.000

APPENDIX D

measured MEASURED AND CALCULATED APPLIED LOAD

Nominal Deflection	0	1/8"	3/16"	1/4"
Average Strain in the Plate (micro-in/in)	604.8	642.0	633.3	601.1
Product Strain-Cross Sectional Plate Area	1814.4	1926.0	1899.0	1803.0
Maximum Strain in Stiffeners	700	720	800	750
	520	650	750	820
Minimum Strain in Stiffeners	-260	-200	-270	-375
	-235	-120	-300	-475
Average Strain in the Stiffeners	181.3	262.5	245.0	180.0
Product Strain Cross-Sectional Stiffeners Area	226.6	328.0	306.0	225.0
Sum of Products Strain-Area	2041.0	2254.0	2205.0	2028.0
Calculated Applied Load (pounds)	59200	63400	64000	58900
Measured Load	60000	60000	60000	60000
Difference (pounds)	-800	+5400	+4000	-1100
Difference (percentage)	-1.3%	+9%	+6.7%	-1.8%

MEASUREMENTS AND CALCULATIONS

Horizontal Deflection	0	1/8"	1/4"
Average Strain in the Plate (also in/in)	604.8	642.0	677.3
Product Strain-Cross Sectional Area	1811.2	1806.0	1809.0
Minimum Strain in Silleners	700	750	800
Maximum Strain in Silleners	250	300	350
Minimum Strain in Silleners	-200	-300	-400
Maximum Strain in Silleners	-250	-350	-450
Average Strain in the Silleners	181.3	202.5	212.0
Product Strain-Cross Sectional Area	205.6	228.0	245.0
Sum of Product Strain-Area	2041.0	2224.0	2254.0
Calculated Applied Load (pounds)	29000	32500	36000
Measured Load	30000	34000	38000
Difference (pounds)	-1000	-1500	-2000
Difference (percentage)	-1.35	-4.62	-5.78

APPENDIX E

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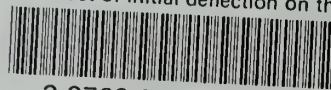
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